TECHNOLOGY DEPARTMENT

DECEMBER, 1948

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Plant Engineering

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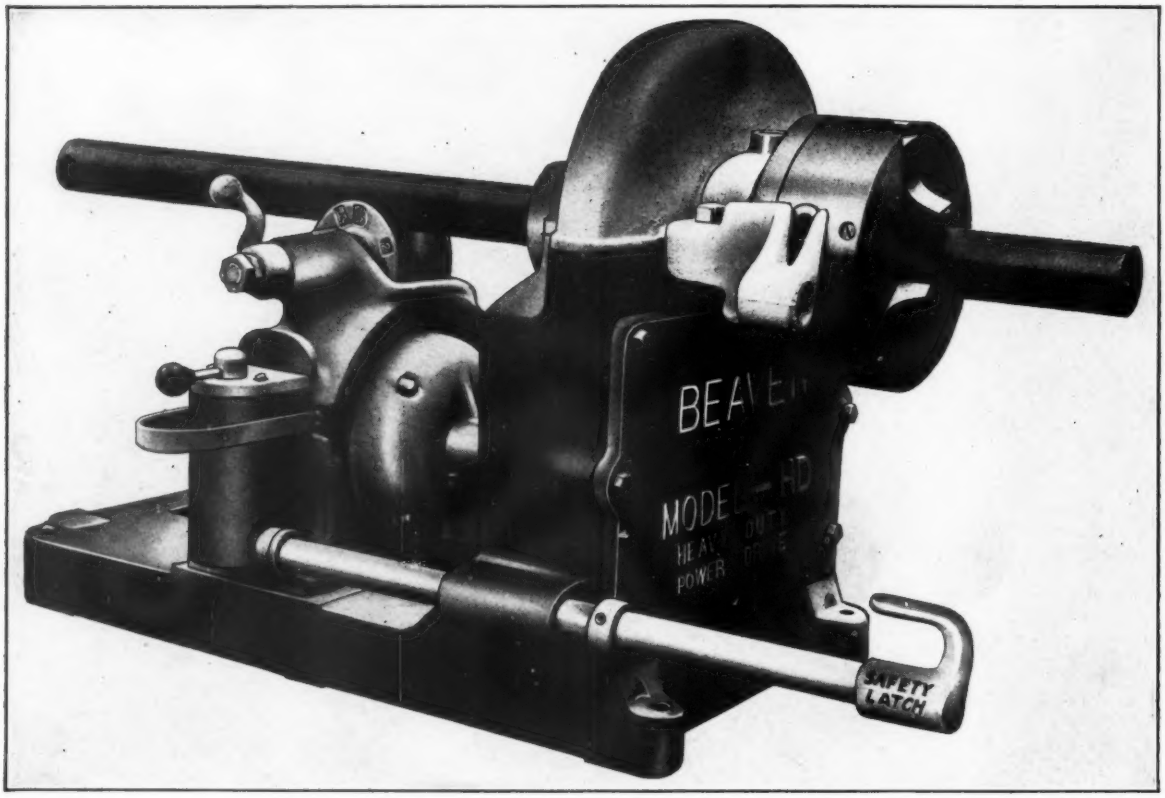
Volume 2, No. 12

The magazine that helps plant engineers with their everyday problems

BEAVER Model-HD *Heavy Duty* Power Drive



Capacity: PIPE, 1-8 to 12 inch. BOLTS, 1-4 to 2 inch.

NOTWITHSTANDING the satisfactory service rendered by light-weight power drives such as the popular Beaver Model C, there is an increasing demand for a rugged **heavy duty** power unit—having a substantial reserve of extra power and a wider range of usefulness. The Beaver Model HD, shown above, is a modernized redesign of the early Beaver No. 44, many of which are still giving trouble-free service after 25 years of continued use . . . and abuse!

The heavy duty six-pole universal motor (not a gear-reduction motor) plus a train of powerful gearing, with unusually large leverage, enable the Model HD to cut and thread pipe up to 12-inch with drive shaft and geared tools—and to cut and thread all sizes up to 2-inch in the machine without slowing down or stalling due to dull dies, etc. By snubbing a rope over a piece of 2-inch pipe gripped in the chuck, the Model HD can be used as a power windlass to raise and lower fixtures; pull cable through conduit; etc. One owner even used one as a windlass to pull his auto truck out of the river after an accident.

Note these mechanical features: Chuck speed about 30 RPM. Universal all steel chuck (⅛ to 2) with automatic chuck wrench ejector for safety. Patented safety-latch to prevent rotation of pipe tool handle as protection to workmen. New outboard cam-type centering device (patent pending)— independent of spindle—to prevent the "whip" of long lengths of pipe from rocking the spindle of machine, causing excessive wear and flat-sided leaky threads. Switch guard. Cast steel-iron housings—for both strength and stability! Universal motor, reversible at switch, can be used on AC or DC. Choice of 110/115 or 220/230 volt. Special voltage motors available on request.

BUY IT THROUGH YOUR JOBBER!

ITEM	Net Weight Lbs.	Shipping Weight Lbs.	Code Word	User Net-Price
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(A) With 110/115 Volt Universal Motor	**284**	**315**	**Powar**	**$260.00**
(B) With 220/230 Volt Universal Motor	**284**	**315**	**Power**	**260.00**
Model HD Enclosed Portable Stand, 17" Wheels	**100**	**128**	**Stand**	**40.00**
Heavy Duty Drive Shaft for Operating Geared Tools	**32**	**39**	**Abita**	**30.00**

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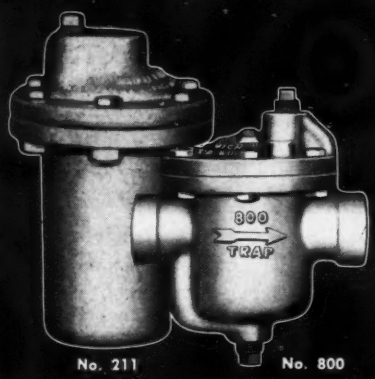

No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right — Armstrong No. 800 side inlet—side outlet trap.

WANT MORE OUTPUT FROM YOUR PRESENT PLANT & EQUIPMENT?

PROOF THAT ARMSTRONG TRAPS PAY DIVIDENDS:

50% INCREASE IN PLATING TANK COIL HEATING TIME after installing Armstrong traps on each tank.—*Proctor Electric Co., Philadelphia, Pa.*

●

PREFAB HOUSE OUTPUT SPEEDED UP by unit trapping with Armstrongs . . . heating time reduced over 50% . . . temperatures 10° higher.—*Riverdale Millwork Co., Chicago, Ill.*

●

PRODUCTION UP 20% as a result of $300 investment in Armstrong traps.—*Small sugar central in Venezuela.*

●

LAUNDRY INCREASES PRODUCTION 150% by unit trapping presses, tumblers, flatwork ironers and unit heaters with Armstrong traps. — *Fame-Penn Laundry, Canton, Ohio.*

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An individual Armstrong Steam Trap on every steam heated kettle, coil, press, unit heater, retort, dryer, etc.—that's the master key that unlocks the full output that was built into your equipment.

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Armstrong Traps are the logical choice for unit trapping installations. They are small, compact traps with big capacity. They discharge air along with condensate, an essential to maximum temperatures. They seldom require maintenance — not stopped by ordinary dirt and scale — won't leak steam — the interior mechanism is made of materials suitable for 1000 pounds pressure, 900° F temperature.

For more details, write for the ARMSTRONG STEAM TRAP BOOK and the name of your nearby Armstrong Representative.

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Published Monthly by

TECHNICAL PUBLISHING CO.
53 W. JACKSON BLVD.
CHICAGO 4, ILL.

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Subscription Information—Published Monthly. Prices: United States and Possessions one year $10.00, Canada one year $11.00. Other countries one year $12.00. Single copies $1.00.

'Round About with the Editors

Re: Industrial Air Purification

Contributed by Robert H. Emerick

AT A CERTAIN point in the study of any problem (for instance, the problem of air purification in industrial plants as outlined in the article on page 36, September issue, PLANT ENGINEERING — Editor) just when it seems well in hand, I find myself invariably entertaining a provoking individual who says he comes from Albuquerque. He claims to be an engineer, explaining that his ten gallon hat is merely a measure for boiler compound, his cowboy boots for safe climbing of plant ladders, and his silver spurs are in truth windmills engaged in pumping water to his plaid shirt which is plainly an evaporative cooler in disguise.

Why he originates in Albuquerque I don't know, unless it is because almost anything can come out of the desert.

Anyway, as always, he manages to focus down his earnest eyes from their contemplation of the wide open spaces, and asks me a question I can't answer.

"Why don't you purify air by passing it over a slightly cooler surface? You've seen the dust streaks around registers, and behind radiators. That's how they got there."

"There's no commercial equipment working on the principle of thermal precipitation."

"Why not? It works. And why not put an orifice ahead of your filter, washer, cyclone, electric precipitator, and use a downstream fan to build up a little vacuum? Even a feather won't float in a vacuum, and dust won't either."

"Do you think an orifice would help?"

"I'm asking you," he insisted.

"Let me think," I said, while he went back to Albuquerque to wait for the answer. I'm still thinking. Can we purify air satisfactorily by thermal precipitation, or by precipitation in a partial vacuum?

Maybe if we all think about it, we will eventually come up with a new technique for industrial air purification. Meanwhile, the reason this man from Albuquerque is so provoking, is that he makes us think, and progress, whether we want to or not.

What's the Answer? P. E.'s Are On Pan!

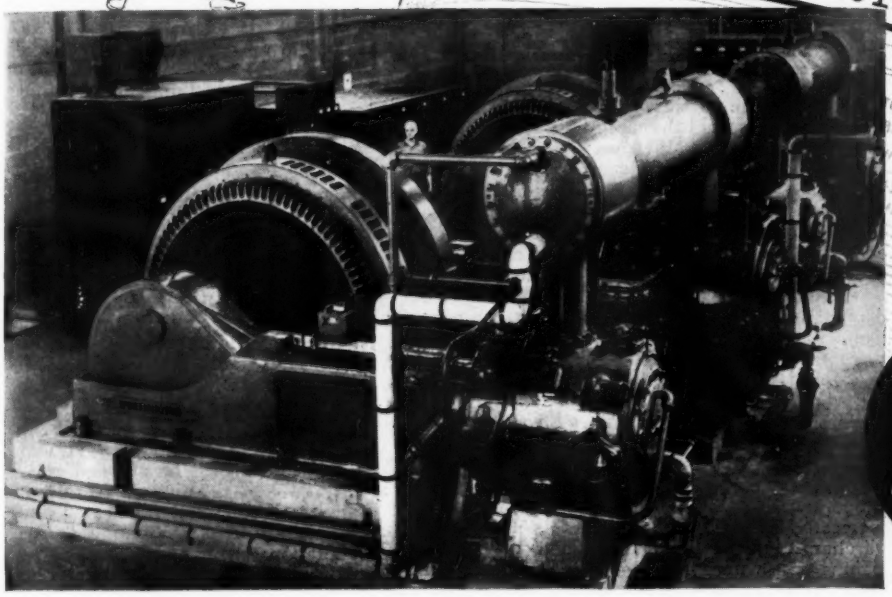
WITH THE election out of the way industry can devote more time to solving its current problems. A survey of 1000 American companies, conducted by the AMA, showed that among the eight most pressing problems two are directly on the plant engineer's doorstep. These eight problems confronting industry's attempt to lower costs and increase output and quality are listed as:

1. Insufficient employee interest in increased production.
2. Inability to meet customer deliveries because of uncertainty of deliveries from suppliers.
3. **Maintenance inefficiency causing time lost for repairs.**
4. **Less than maximum effectiveness in physical handling of materials in the manufacturing process.**
5. Inadequate leadership by foremen and supervisors.
6. Lack of sufficiently close coordination between production engineering and sales.
7. Inadequate inventory controls in scheduling full use of equipment for plants producing a wide variety of products.
8. Interruptions of production where design changes rapidly.

Editor's Note: Several thousand readers are in the plant engineering departments in the 1000 plants covered by this survey. A large proportion of you men are in direct charge of an operation that is responsible for 25 per cent of industry's major ills. Can you justify your position? Have you fulfilled your responsibility by making practical recommendations for improvements? If you were given free rein could you whittle these two major problems down to normal size? Are your ideas practical or would they bankrupt the company. In other words, are you individually a plant engineer, or do you prefer the universal alibi, "no one told me to do it"?

Plant Engineering is published monthly at 53 W. Jackson Blvd., Chicago 4, Ill. Subscription price $10.00 per year to U. S. A. $11.00 to Canada. $12.00 to other countries. Single copy $1.00. Application is pending for acceptance under Act of June 5, 1934.

LONG-RANGE FORECAST: "Considerably Cooler with Lower-Cost Air"



Worthington Horizontal Duplex Compressors, Type DC-2
A plant installation of two 600 hp units

You can depend on this prediction of Worthington compressor-performance to be 100% accurate — every time! In DC-2's, for example, cooler operation is assured by such exclusive Worthington features as:

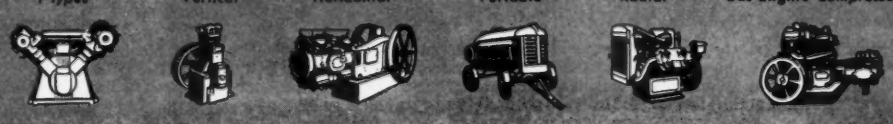
- **Advanced Variable Capacity Control** — Most modern, simple and flexible ever devised. Accurate, automatic regulation that cuts down operating heat with better lubrication and reduced carbon deposits.
- **Improved Intercooling** — High-efficiency design that provides maximum cooling with minimum water, for lower power requirements and lower operating temperatures.
- **Feather*Valves**—Lightest, tightest, most efficient ever made — a famous Worthington contribution to compressor-development.

These and many other DC-2 advantages mean not only more air for less money, but longer compressor life and constant savings in power and maintenance costs. Bulletin L-675-B1A has the complete story that proves *there's more worth in Worthington.* Write for your copy to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.* *REG. U. S. PAT. OFF.

WORTHINGTON

K2-5

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



Plant Engineer's Digest

Short articles selected from current publications and condensed for quick reading to save time and give quick reviews of a wide range of industrial topics

Conveyor Opening Protection

PREVIOUS announcements have been made of research and tests which show that it is practical to arrange high velocity spray nozzles to prevent the passage of fire through conveyor openings in walls and floors. Thorough investigations and tests have now been completed and detailed specifications are available for such systems.

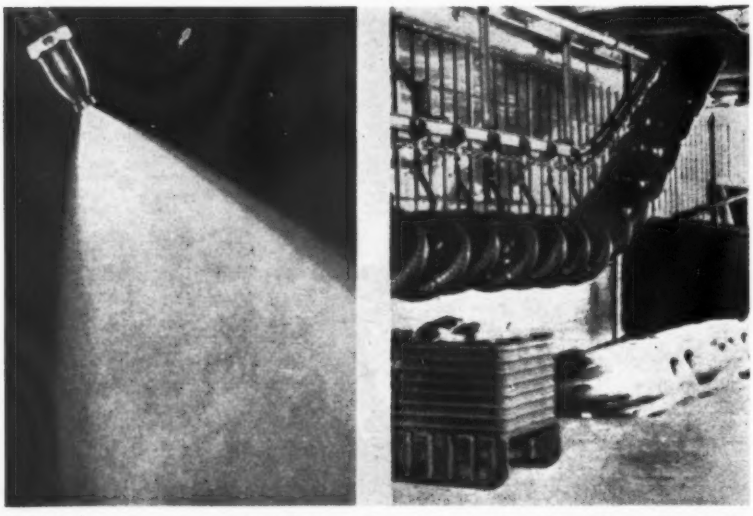
Nozzles having a solid conical spray pattern are the most effective type and must be so arranged that the entire opening is well covered with dense spray.

Conveyor openings in walls will usually require an independent system of nozzles on each side of the wall to protect against fire on the other side. At the floor opening only one system of nozzles located above and arranged to discharge downward through the opening is necessary.

For prompt operation, thermostats connected to automatic releases which will quickly open the water supply valve are recommended. Important considerations also include the adequacy and reliability of the water supply, and the location of the nozzles with respect to the opening and the material passing through on the conveyor.

Best results are obtained with a sheet metal or other non-combustible spray enclosure extending from the opening to the nozzles, thus producing a more effective counterdraft and greater cooling action. With enclosures, the greater distance from the nozzle to the opening, the greater the cooling effect. The nozzles, however, must not be located so far away that cooling cannot be maintained up to the opening. Water spray protection at wall openings is not a substitute for, nor the equivalent of, standard fire doors. Also, it is not a substitute for stair or elevator enclosures.

The chief use of this new type of protection is confined to openings where fire doors in first class fire walls or fire resistant enclosures at floor openings ordinarily would be needed, but where such installations would not function effectively. *From the September issue of Factory Mutual Record, a publication of Associated Factory Mutual Fire Insurance Companies, Boston, Mass.*



A high velocity water spray will stop a fire at floor and wall openings. The photograph at the left shows a nozzle with a solid conical spray pattern which is of the most effective type. These nozzles must be arranged so that the entire opening as shown at the top right in the second photograph is well covered with dense spray

Engine Hazards With F. W. Heaters

WHEN A reciprocating steam engine is used in connection with an open feedwater heater, the engine is subject to certain characteristic hazards which are frequently overlooked. There have been many accidents caused by the backing up of water from an open heater through the exhaust pipe into the engine cylinder. An occurrence of this kind is more likely to happen when the open heater is set on the same level as the engine, as is most often the case, or when the open heater is set at a higher level than the engine.

In either case, as shown in the drawing, there is an exhaust pipe loop in which water may collect, particularly at the time of starting the engine from a cold condition. If provisions are not made for the prompt and continuous drainage of water from the loop, it may be drawn into the engine cylinder should the engine be stopped suddenly. When the engine stands at a higher level than the heater and the exhaust loop is eliminated, the installation is much safer. There is an overflow outlet in the heater to prevent the water in the heater from rising to a level where it might flow into the exhaust pipe. Experience has shown, however, that overflow outlets can become clogged with grease and scale deposits and when this happens the water may enter the exhaust pipe and lead to serious trouble with the engine.

In the case of an open heater subjected to pressure, the overflow must function through a flow trap, as shown in the drawing, or through a similar device serving the same purpose. As a mechanical device, the trap is, of course, subject to derangement; furthermore, the flow of excess water through the trap is likely to be slower than the simple gravity overflow of a heater that is subject only to atmospheric pressure.

The sudden filling of an open heater with an excessive amount of water may occur when there is an accidental stoppage of the boiler feed pump at a time when the float-regulated water inlet valve is out of order. Accidental stoppage of the boiler feed pumps is not always promptly observed, particularly when the pump is located out of sight, as in a basement under the engine room floor. Another circumstance that may permit water to be drawn into the cylinder is when the exhaust pipe loop becomes flooded during an idle period of the engine. Periodic inspections of open feed-

with a GE Hook-on Volt-Ammeter

Motors that loaf on the job cost you money

More efficient operation and lower operating costs are possible from accurate motor-load analyses made with an AK-1 hook-on volt-ammeter. This handy testing instrument helps locate motors which aren't carrying a full load . . . helps catch those "loafers" which may be costing you power-rate penalties.

Spot trouble before it starts

Experience shows that periodic checks of plant electrical systems and equipment prevent trouble. They reveal unsatisfactory conditions—such as overloaded and underloaded motors and inadequate wiring—which when corrected will result in reduced power costs, less maintenance expense, and increased production.

Easy to operate

Just hook it around a conductor, and flip selector switch to one of three current ranges. No cutting of conductors, no interruption of service. You'll have information in a jiffy on any of six ranges: 0-15/60/150/600 amps and 0-150/600 volts (for a-c circuits only).

Let this light-weight, low-cost tester go to work for you today. You can order from stock. See your nearest G-E apparatus representative. Or write for Bulletin GEA-2950 for more complete details on this versatile instrument. *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

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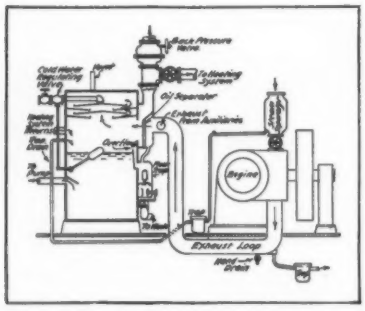


The above drawing shows an open type feedwater heater designed for slight back pressure. Note the hand drain at the lowest point in the exhaust loop

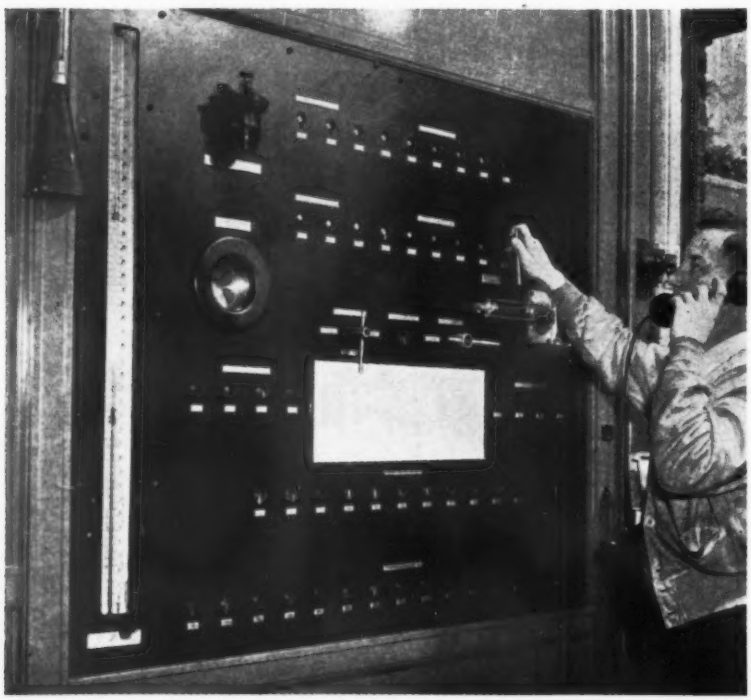
water heaters are as important as the "at rest" or disassembled inspections of steam engines used in conjunction therewith, and in addition to a careful examination of the heaters, special attention should be given to any exhaust pipe loops. The following points are also important: (1) There should be a suitable continuous drain of the exhaust pipe loop. Where the exhaust steam is used at atmospheric pressure, an open drain outlet at the lowest point of the loop. In the later case there engines operating against back pressure, there should be a reliable pressure trap for constant drainage of the loop. In the later case there should be a hand-operated drain in addition to the trapped drain. (2) The heater and the overflow outlet should be periodically cleaned of any scale, grease, or other substance that may have accumulated and which may eventually clog the overflow. (3) The physical condition and operating ability of the float used for the water inlet valve and for any overflow trap should be carefully checked. These floats should not be permitted to become water-logged and should be free to move with any fluctuations in the water level. (4) The steam from any auxiliaries, such as pumps, should not enter the exhaust pipe loop, but in all cases should be piped directly into the heater. (5) Any drain from live steam pipes should be piped directly to the heater, never to the exhaust pipe loop.

It is very important in connection with any open heater which is located on the same floor level as the steam engine, to make sure that no water drains of any kind are piped into the exhaust pipe loop. In a number of installations it was found after an accident had occurred, that someone had rearranged some drain piping of the heating system connected with the open heater and had connected such drains into the engine exhaust pipe without considering the hazard introduced by the arrangement. Later there was serious trouble caused by the engine taking in water from the exhaust pipe loop at the time the engine was being started or stopped. *By H. J. Vander Eb, Asst. Chief Engineer, Turbine and Engine Division, in The Locomotive, a publication of The Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn.*

Fuel Storage Helpmate

DETERMINING how much gasoline remains in storage in an underground tank at any given time once was an inconvenient and often a not too accurate procedure. Usually, it meant inserting a stick into the tank and then noting the stick where the level of the gasoline had made its mark. In the days before the fuel gage motorists did the same thing to find out how much fuel was left in the tanks of their cars. Today, however, fuel-in-storage determination has been simplified to such a degree by accurate measuring instruments that it is almost a push button operation.

At the Ethyl Corp. Research Laboratories in Detroit, this job is performed by an ingenious device known as the Pneumacator. This is a maze of individual copper pipes leading from an inside control board to the outside storage tanks, each line ending at the lowest point within its respective tank. The Pneumacator consists of 52 lines, one for each tank in the underground storage field. These tanks vary from 500 to 10,000 gal size and have a total capacity of 132,500 gals. Fuels in the tanks are inventoried each day.



This is the Pneumacator which tells Ethyl Corporation Research workers how much gasoline remains in each of 52 tanks at the Research Laboratories in Detroit

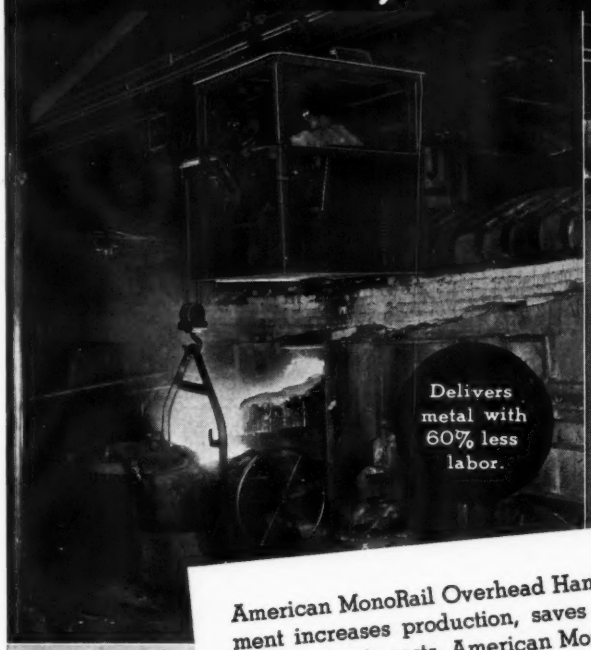
Briefly, the Pneumacator works in this manner: air is bled through the copper line at both low pressure and low rate. Depending on the gasoline level in the storage tank, the weight of the gasoline offers a specific resistance to the air and thus creates a static air pressure in the line. This pressure is indicated on a manometer. A prepared chart that relates the inch height of fluid in the manometer to the number of gallons of gasoline in the tank makes it possible to determine exactly how much gasoline remains in storage. For a 10,000 gal. tank, for instance, a 13-in. reading on the manometer reveals that 3,295 gal of fuel remain. If this reading is obtained with a 500-gal tank, it means that the tank is full.

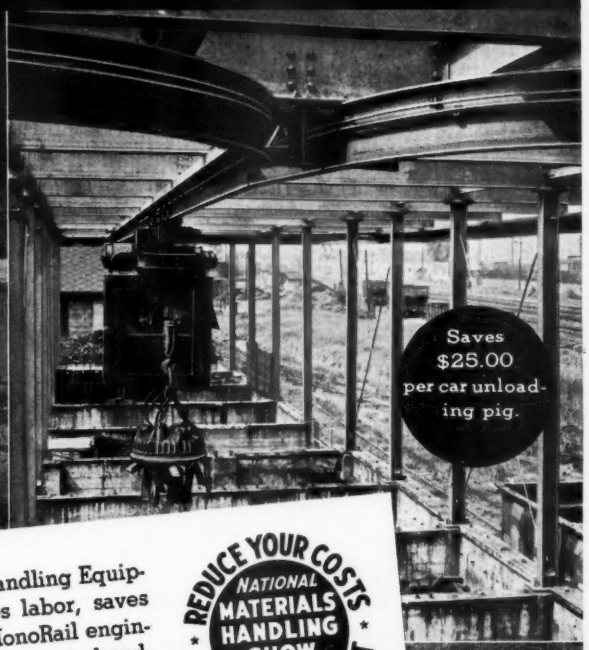
The incorporation of a small pump in the system and the rearrangement of the Pneumacator valving permits samples of newly-received fuels to be drawn off quickly and conveniently for inspection or for "screening" in small single-cylinder engine tests. Also, this arrangement can economically suck out any insoluble contaminant or "water heel" that may have found its way into the fuel. *From the September issue of Ethyl News, a publication of Ethyl Corporation.*

(Continued on page 48)

AMERICAN MONORAIL EQUIPMENT

Pays and Saves





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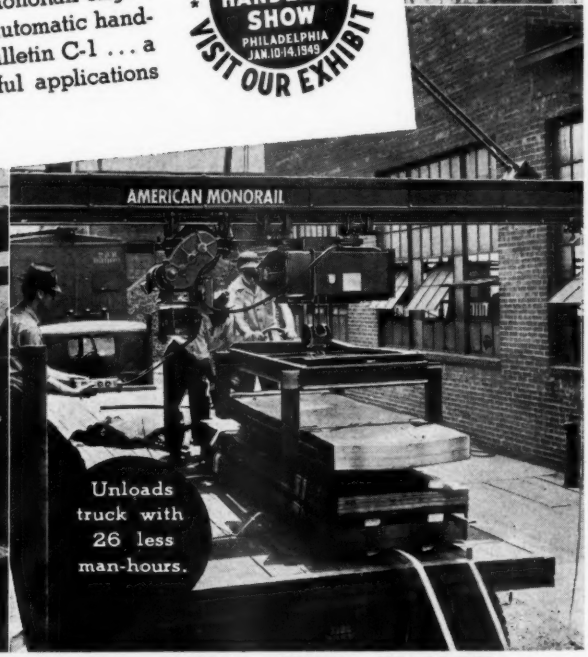


THE AMERICAN MONORAIL COMPANY

13123 ATHENS AVENUE CLEVELAND 7, OHIO

Maintenance and Operation

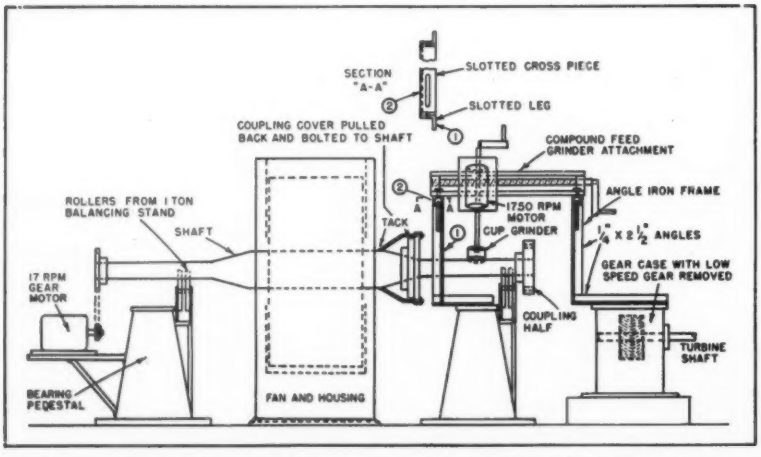
Grinding Shaft in Place

Contributed by
M. J. Hurd

ENCLOSED is a description and sketch of an interesting shaft repair recently set up and supervised by the writer. I am forwarding this with the idea that this repair would be an interesting subject for your maintenance section.

The shaft shown is in an induced draft fan at one of our plants and is 9 ft-8 in. long overall, 8 in. in diameter at the fan hubs and 2 11/16 in. in the journals. The shaft had worn out-or-round due to past unbalance of the fan wheel — approximately 0.023 in. on the coupling end journal and it was necessary, in order to improve bearing life and reduce vibration, to remove the out-of-roundness or replace the shaft. Delivery time on the new shaft, plus the time for the difficult installation eliminated the possibility of an early replacement and thus it was decided to make a repair.

A discarded shaper blade grinding attachment, having infeed and crossfeed screws, was located at another of our plants and on this attachment we installed the motor and cup grinder shown in the picture. The grinder attachment was mounted above the shaft on an angle iron framework secured to the bearing pedestal at one end and to a steam turbine casing at the other end. The framework was slotted for vertical and horizontal adjustment of the grinder with the shaft. The shaft was mounted and leveled on balancing stand rollers supported on brackets welded to the bearing pedestals. The shaft and fan were rotated at 17 rpm by a ¾ hp gear head motor and sprocketed speed reduction—attached at the free end of the shaft as shown. The shaft was ground true within —0.001 in. and a new bearing poured and scraped to fit. The unit has been back in operation for the past month, with no bearing trouble or unusual vibration.



Sketch showing location of driving gear motor, feed grinder attachment and rollers from balancing stand

Stopping Air Hose Leaks in the Field

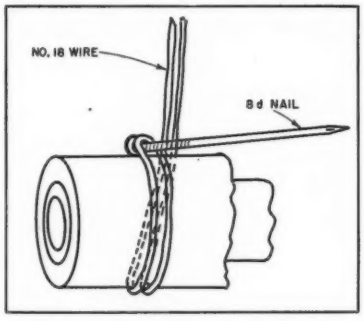
Contributed by
H. B. McDermid

IGNORING SMALL leaks in the various parts of compressed air systems may involve severe penalties in loss of pressure and accomplished work. A practical demonstration of the value of a tight system can be observed when, with a 100 ft capacity compressor, a ⅜ in. valve, for example, is left wide open. Pressure will never build up on the system until the valve is closed.

Scattered small leaks also will bleed the system in the same manner and usually will go undetected. It generally will not be noticed unless someone deliberately checks the unit at a time when there is no demand on the compressor. It has been found, in many cases, that fully half the compressor running time is spent in pumping against leaks.

Leaks are often tolerated by operators because they seem trifling. The increased power delivered to the tool, when the line is made leakproof, is startling. Many times, especially when operating in the field, the proper tools do not seem to be available for making good repairs. Quite often, however, the leaks are in some one of the hose-to-nipple connections; with the perversity of inanimate objects, screwdrivers are usually well-hidden from view so that the hose clamps cannot be tightened. When the screwdriver is found it often fails because the hose clamp has become distorted, stretched, or for some other reason fails to stop the leak.

The writer once observed a steel foreman stop a leak on a hose-to-nipple joint in jig time. This foreman passed by a pneumatic hammer when the operator was away, heard the hissing of the leak and started looking around. He soon came up



The nail furnishes plenty of leverage for twisting and the doubled wire furnishes sufficient strength and ductility for stopping leaks in hose-to-nipple joints

with a bit of stray No. 18 wire and an 8 penny nail. He doubled the wire and wrapped it around the hose and nipple as shown in the accompanying sketch. Then he stuck the nail through the looped end of the wire and started twisting it around the standing ends.

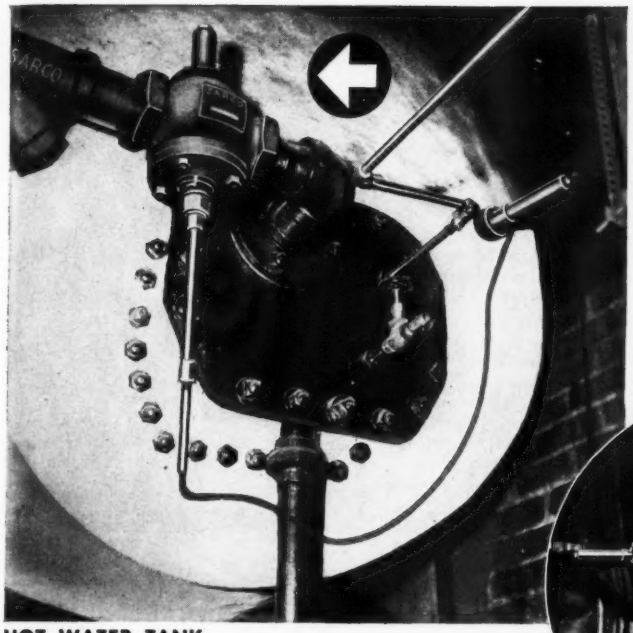
This results in an emergency job but it *does* stop the leak, does it quickly, and does it better than one can do it with a pair of pliers.

Spacing Shaft Hangers

Contributed by
S.F.W., New Jersey

DESPITE the rumors we hear every so often that belting and shafting are "extinct," the fact remains that shafting is still being manufactured in large quantities, and so is belting, and both products are still being purchased by users. The same is true of shaft hangers; questions continue to come in regarding the proper spacing of hangers.

In the "old days" the spacing of hang-



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It's not a luxury to have all hot water services Sarco Temperature Controlled. In fact, on most jobs, the controls pay for themselves in four ways.

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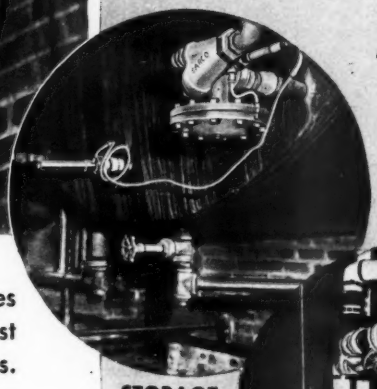
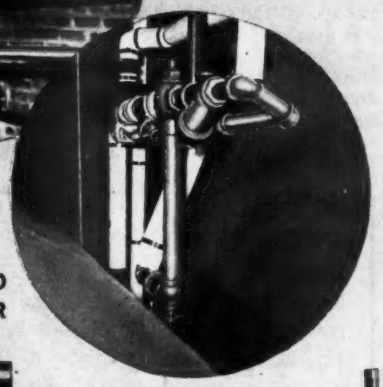
4. Everything works, 24 hours a day, without shut-downs or complaints.

In a factory, a service tank was controlled for twenty-four years at a cent a day. A mine saved hundreds of dollars by installing Sarco Blenders for showers, and dish washing.

What would Sarco Temperature Controls save in your plant? Why not ask the Sarco Man near you?

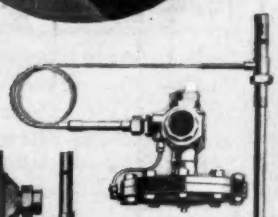


STORAGE TANK



BLENDED WATER

MB BLENDER



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ers was largely a matter of guess work. But today when the up-to-date buyer wants to hang some shafting he first measures the diameter of the shafting carefully, notes the number of pulleys to be carried, where the pulleys are to be placed, and then consults his installation handbook.

To assist readers who may have shafting jobs to do in the future here are two charts. The chart on the left is for shafting without pulleys; and the other chart is for shafting with pulleys.

To use the chart, let us take this example: How far apart should hangers be spaced on 2-in. shafting, on which there will be no pulleys?

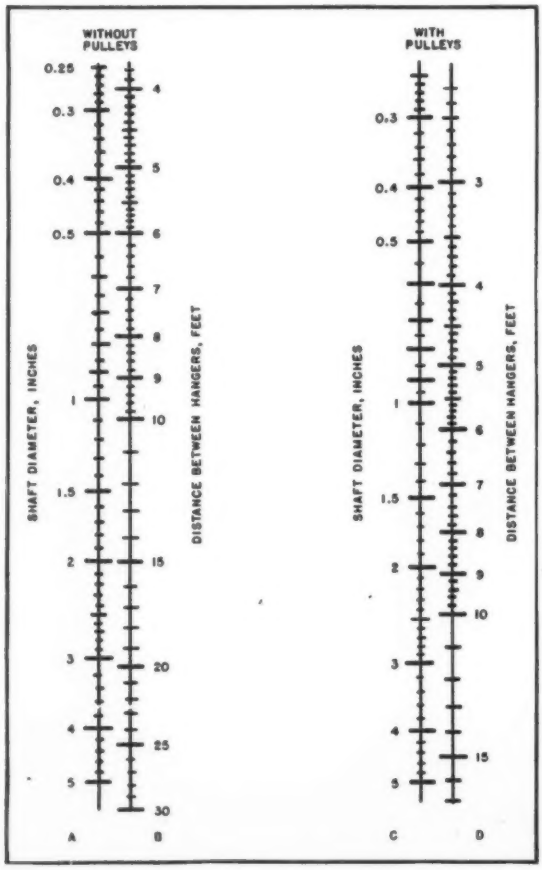
Find the 2 (column A) and glance across to column B and there is the answer—practically 15 feet apart.

Again: How far apart should the hangers be spaced where an average number of pulleys will be employed, properly spaced close to the hangers?

Find the 2 in column C this time and glance across to column D. The answer is—about 9 feet apart.

Of course, where the shafting is to be heavily loaded—more heavily than average—the distance should be even less than given in column D. That is where the buyer or installation man must apply directions given in installation handbooks, or, mighty good judgment.

As will be noted, the charts take care of shaft diameters from one-fourth of an inch to 5 inches. In practice we seldom have shafts that are smaller or larger than those limits.



This chart may be used for quickly calculating the correct spacing of shaft hangers

Heating High-Ceilinged Fabricating Plant

Contributed by
Dravo Corp.

CEILINGS must be high in many steel fabricating plants and this makes the problem of space heating more difficult than in an ordinary structure.

Such was the case at the new plant of Penn Iron Works, Reading, Pa. In one bay, the ceiling is 32 ft high and in the other 20 ft. Maintaining a design temperature of 65 F at the breathing level, 5 ft above the floor would mean, under ordinary conditions, stratification of hot air in the space above the workers' heads.

The system selected is one that operates on the principle of "working level" recirculation. With this method, warm air is discharged at high velocity just above the workers' heads from two direct-fired 1,000,000-Btu capacity heaters, one located on the floor at each end of the building. The equipment is fired by fuel oil although it can be readily converted to use gas. Air is drawn from the floor into the base of each heater through grilles. It passes over two banks of economizer tubes equipped with swirlers to "whirlcool" the hot gases of combustion before they enter the vent stack. The partially warmed air continues on sweeping the combustion chamber. Fuel-to-air heat transfer is effected rapidly.

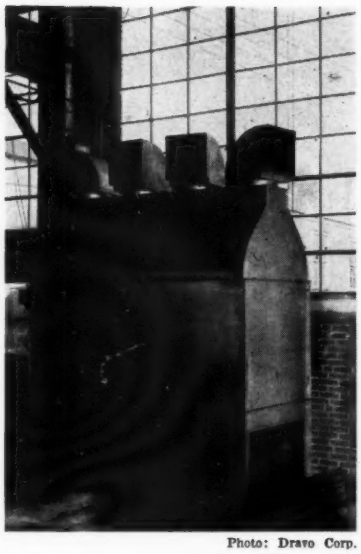


Photo: Dravo Corp.

One of the two heaters that maintain correct working temperatures in Penn Iron Works' plant. Air is drawn into the heater at the base and is discharged at high velocity through overhead nozzles

Approximately 11,000 cfm of warm air—about 80 F above room temperature—is discharged into the working area from four directional nozzles on each heater. The rate of cold air flow from the floor area is so low there are no appreciable drafts even a few feet away from the heater.

This method establishes a "comfort zone" extending from the floor to about 10 ft above the floor. Upward flow of heat is minimized by the balancing effect of cold air being drawn from the floor to the heater.

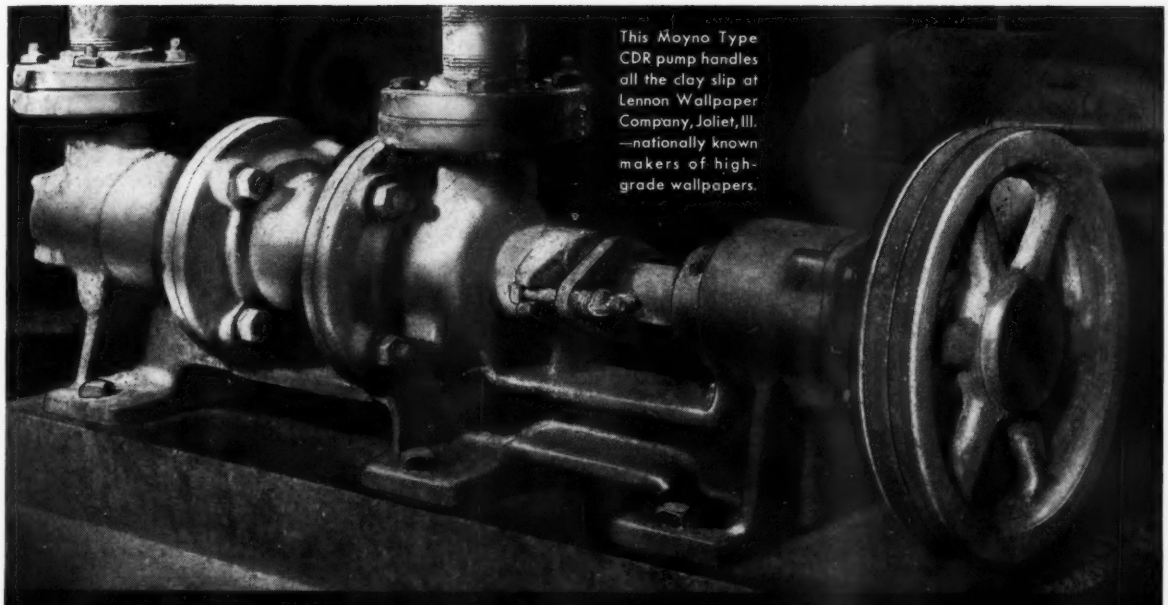
These Hose-Nipple Joints won't Slip

Contributed by
H. Mack

WHILE WORKING as a maintenance mechanic the following interesting hose kink was encountered. The work was hand riveting 5/8 in. and 3/4 in. cold rivets with heavy pneumatic hammers which were supplied through 3/4 in. hose at 110 psi. The hose-to-nipple joints were supposed to be held in place by the ordinary sheet metal stamped hose clamps and all parts were new. However, the service was extremely severe and the clamps occasionally were torn or distorted.

When some of the operators, who were being paid on a piece work basis, would get behind in the work,

(Continued on page 16)



This Moyno Type CDR pump handles all the clay slip at Lennon Wallpaper Company, Joliet, Ill. —nationally known makers of high-grade wallpapers.

How Lennon CUT Pump Maintenance

...AND GOT BETTER PUMPING, TOO

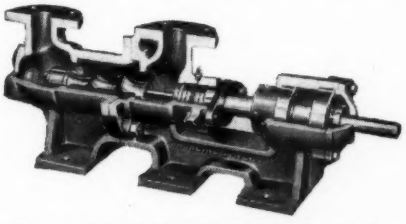
Lennon Wallpaper Company's experience is a tip on how *you* can get *better* pumping. Maintenance problems disappeared when they installed an R & M Moyno "Progressing-Cavity" pump to handle clay slip (for color coating). After a year's operation, *not even a dime* has been spent for repairs.

"NO TROUBLE AT ALL"

The Moyno has handled over 300,000 gallons of slip, pushing it through a 2½-inch pipe, 180 ft. horizontally and 20 ft. vertically. "We're very happy with our Moyno," says R. Dagon, Superintendent. "It's been running steadily for well over a year, and we've had no trouble at all."

TYPES FOR ALL NEEDS

Moynos pump virtually *everything* from volatile liquids to non-pourable pastes. They pass particles and solids in suspension—resist chemicals and abrasives—save maintenance *and money* by constant, dependable operation. They meter flow, self-prime, and reverse; deliver smooth, *non-pulsating* discharge at pressures to 1000 p.s.i. If *you're* having pumping troubles, call in a Moyno man—chances are he has *your* answer, too. Distributors from coast to coast. Write today.



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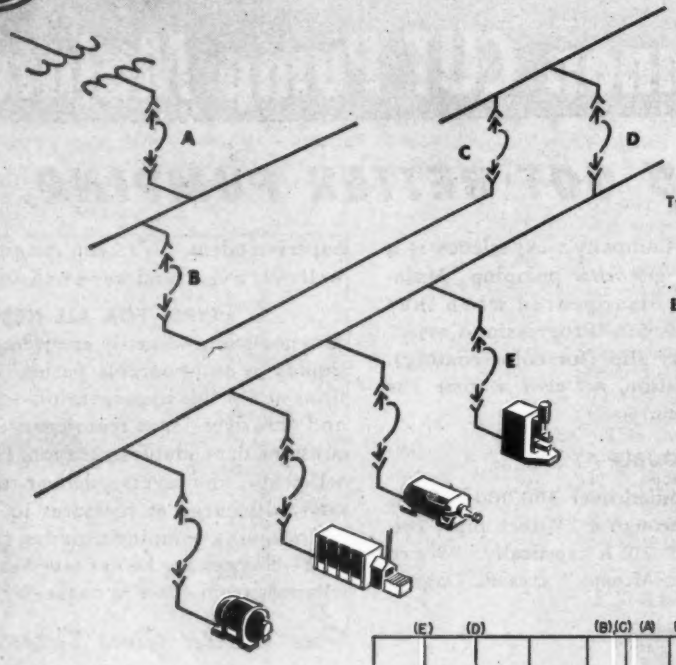
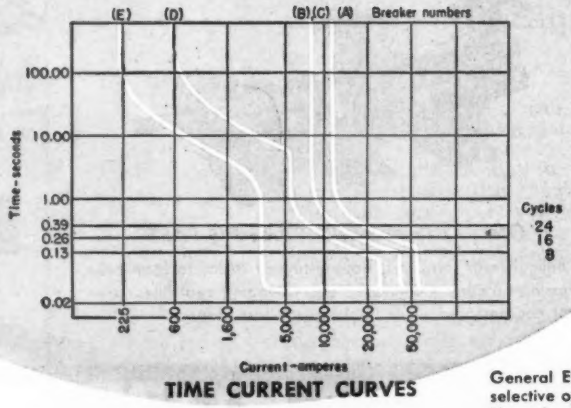
SELECTIVE TRIPPING...



Typical selective-operation low-voltage distribution system.

A	Main Supply Breaker
B, C	Bus Tie Breakers
D	Feeder Breaker
E	Load Breakers



TIME CURRENT CURVES

The time current characteristic of the load breaker E of a typical low-voltage distribution system is shown at the right. A fault of 20,000 amperes trips this breaker instantly and the fault current, which also flowed through breakers A, B, C, and D, is interrupted in 2 cycles or less. If the current persists for as long as 8 cycles, breaker E has not opened and the fault is not at the load but must lie between breakers D and E. After 8 cycles, breaker D trips, and interrupts the circuit. If the fault persists for 16 cycles, breaker D has not opened and the fault must lie between breakers C and D. Breaker C then trips and interrupts the circuit.

General Electric first develo... selective operation for the U... Navy in 1944 for protec... of electrical distribution syst... on shipboard.

POWER SHUTDOWNS

USE THE NEW AK-1 AIR CIRCUIT BREAKER

With this new breaker you can set up completely selective low-voltage power distribution systems using full interrupting-rating breakers. Selective systems eliminate costly production delays caused by main breaker tripping. Faults at remote points are isolated; will not trip the main supply breaker.

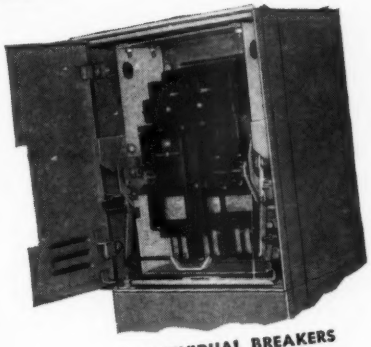
NEW, SEALED TRIPPING DEVICE on the AK-1 makes selective operation possible. It causes the feeder breaker to wait for operation of the load breaker; the main supply breaker or bus tie breaker to wait for operation of the feeder breaker.

DELAYED OVERCURRENT TRIP DEVICE is easily removable. It may be replaced in the field by a factory-calibrated unit either to change the current rating or to obtain different characteristics. Pickup of the long-time or short-time element is readily adjustable. Time settings are fixed to avoid incorrect sequence.

LONG TIME DELAY is obtained by a positive displacement piston operating in silicone fluid. The silicone fluid prevents sludging and reduces the effect of ambient temperature. Complete sealing of the element eliminates any maintenance. Short-time delay of 8, 16, or 24 cycles is produced by a simple mechanical escapement.

GENERAL PURPOSE LOAD characteristics provide 5 seconds delay at six times normal current for normal overload protection. For motor starting, a second characteristic is available, giving 15 seconds delay at six times normal current. The instantaneous trip is set to operate at 15 times normal.

For complete information about selective operation on your system with the new AK-1 breaker, see your G-E sales representative. Also, write for bulletin GET-1485 "Selective Operation with Air Circuit Breakers." Apparatus Department, Section N860-34, General Electric Company, Schenectady 5, New York.



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Multiple arcing contacts
Interchangeable trip units
Interrupting capacity
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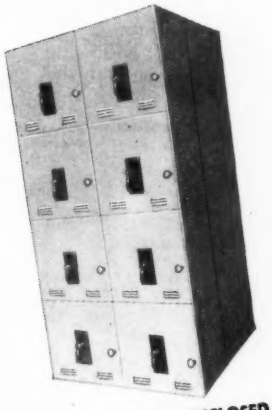


METAL-ENCLOSED DRAWOUT UNITS
Smaller space required
Improved bus construction
New rack-out mechanism
Easily removable breakers
Ask for bulletin GEA-4966

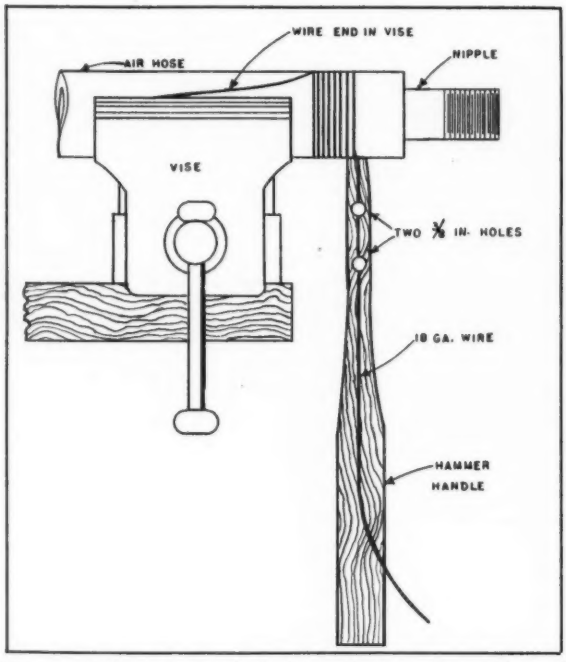
GENERAL ELECTRIC

350-34

they were absolutely merciless in their abuse of equipment. The net result was that nearly all the "tail" hoses were leaking and many were blowing off the nipples. A line of men eager to get back to their piece work was always in place alongside the repair man's bench, and though he tried every possible method known, and did his very best, the situation was bad and steadily getting worse.

Finally he got a tip from a friendly operator who had been through the same experience. This solved the problem. The joints were well made and the line of waiting men melted away. Not a joint failed, except from natural wear and tear, so when the last of the equipment had received the treatment, the trouble of that sort were over.

Here is what was done: First, make sure the nipples are a tight fit in the hose with proper notches made in the outside of the nipples to provide anchorage of the hose to the nipple. Then get a piece of hard wood to use for a serving tool (a piece of discarded hammer handle 8 in. long is ideal and usually easy to find). Taper one end so you can work up close to the vise with it. This end should be flat like a blunt cold chisel. Then drill two ⅜ in. holes through the tapered end, parallel to the blunt edge of the point and not less than 1½ in. from the edge for the nearest one and another about the same distance above it. Starting at the upper hole, thread a piece of about No. 18 soft iron wire through it, and down through the hole nearest the point, allowing about 6 in. to project beyond the point, and some 30 in. out through the upper hole.



Insert the nipple in the hose, place the hose in the vise with one end of the soft wire held securely. Next, thread the other end of the wire through the two holes in the hammer handle and start wrapping. The author guarantees that this hose-to-nipple joint will not come loose

With the nipple properly prepared and inserted in the hose, clamp the hose end and the short end of the wire in the vise, allowing approximately 2 in. of the hose to project. Now holding the long end of the wire up alongside the handle of the tool to provide friction, wind the wire tightly around the hose and nipple till a band perhaps an inch wide is formed. Next, twist the ends of the wire together, bend over and imbed the ends into the rubber of the hose and you have a real joint that will stay till the materials wear out. At first be careful that you do not cut the hose too much by overpressure of the wire. The beginner nearly always breaks some wire by sheer overstraining before he learns how easy it is to put on too much pull. With a little practice a smooth, tight joint can quickly be made, one that is smoother on the hands than most and can be put on anywhere there is a vise and a few hand tools.

Questions and Answers

Why Insulation Failures?

In the November issue of Plant Engineering, M. MacDonald posed the following problem: We have a 100 k wd-c 250 v generator feeding a direct current system on which we operate 3 cranes, magnets, magnetic pulleys and chucks. We operate an ungrounded system with 10 circuits emanating from a central distributing center. Our crane magnets are controlled by automatic controllers.

Trouble has been experienced with insulation failures in interpole coils, controller fingers, control coils and cable feeders, all failures going to ground. Our direct current system is an ungrounded system which we prefer as we can operate temporarily in cases of a single ground.

We have used Thyrite arrestors as surge protectors on some contactor coils, discharge resistors on all of our magnets and we still are plagued with insulation failures to ground. There have been no direct shorts on our system. Ground indicator lamps are used to indicate a system ground and in some cases these have been blown apart due to a surge condition.

We would like to know of the experiences and corrective measures taken to prevent the reoccurrence of this trouble by your many readers. We have considered the use of grounding resistors, low voltage surge arrestors and capacitors but have not contacted anyone with experience in application of such devices for our apparent trouble.

Contributed by
E. H. Frederick

The most probable cause of Mr. MacDonald's difficulty is, I believe, a combination of circumstances. With many inductive devices, such as solenoid coils or brake coils in the circuit, surges in voltages will occur as these devices are de-energized, even though discharge resistors of proper value are used.

Ordinarily, these voltage surges (using discharge resistors) would not exceed twice normal voltage, which potential any insulation in good condition should easily withstand. If the insulation to ground is weak because of a deposit of conducting or semi-conducting, dust corrosion or overheating, breakdowns are very like to occur.

The following steps are recommended to remedy the situation:

a. Check all insulation with a megger to locate probable trouble spots.

b. Clean up any deposits of dust

Your Plant may be LARGE? SMALL? RECTANGULAR? SQUARE?

Regardless of size or shape **THERMOBLOC** unit heaters will answer your heating requirements

This new, revolutionary unit heater, delivering 550,000 b.t.u.'s, is adaptable to any heating problem. Where larger areas are involved, several units may be installed at strategic points, approximately 100 feet apart.

THERMOBLOC is only 30" in diameter at its base and operates at an efficiency of 82%-86%. A diffusion of 360° permits placing the heater in the center of the room. Where more than one is required, or where it is necessary to place units against a wall, one or more outlets may be closed, to provide directional flow. Outlets may also be "piped" to private offices or other rooms in the plant that do not require the full heating capacity of the unit.

The flexibility of installation available with THERMOBLOC unit heaters makes possible a variety of solutions to any heating problem. Small space factor, high output, above average efficiency, draft-free circulation and adaptation as a circulator of cool air, taken from the floor level and delivered to working level in the summer, gives all that is desired in a heating unit for your plant.

Do you need more boiler capacity? Increase it by handling your heating and drying load with THERMOBLOCS. Write or mail coupon for Bulletin #300.

These floor plans illustrate method of THERMOBLOC installation; depending on size of plant, THERMOBLOC may be placed against the wall or even in a corner.

THERMOBLOC DIVISION

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I would like to have further information on the New Thermobloc Unit Heater. My heating requirements are _____ sq. ft floor space

NAME _____

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or evidences of corrosion or overheating.

c. Make sure proper values of discharge resistors are used with each device, so that voltage surges are kept to a minimum value.

More on the Brain Teaser

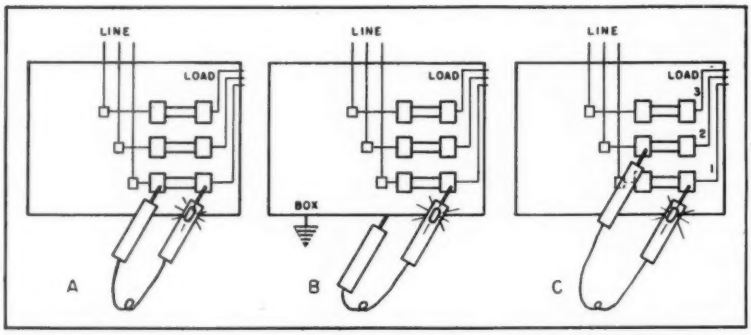
Contributed by J. M. Carter

THE ANSWERS of Messrs. Dodds and Ryan to the August, 1948, seven-wire conduit question look rather like tedious procedures to me. In fact, maybe they could identify the conductors as outlined, but I don't believe I could. The following steps look much simpler.

In manhole A, I would hook the battery to any two of the wires, grounding one side to the pipe, as shown in Fig. 1. Four of the remaining five wires would be twisted together in pairs as shown. The open wire and the two connected to the battery could be numbered right away. Call the open wire No. 1, the one on the grounded side of the battery No. 7 and the other No. 2.

Taking the bell to manhole B, I would locate two wires which would ring the bell. The one common to the pipe would be No. 7—the other No. 2. The last named would be connected to one of the remaining five (No. 3 as shown at "a"—Fig. 2). Then the wire which rang the bell with No. 7 would be numbered 4. Next No. 7 would be connected to one of the remaining three wires, called No. 6, (connection "b" Fig. 2) and No. 5 found the same way. The dead wire would, of course, be No. 1.

Leaving connections A and B intact, I would then return to manhole A. The four unindentified wires could each be No. 3, 4, 5 or 6, except that No. 6 alone is grounded. When the grounded wire is located, the one which had been its mate is known to be No. 5. Wire No. 3 can be distinguished from No. 4 because No. 2 and No. 3 are common conductors. No guess work—a minimum of "cut and try."



A—Shows a parallel test with load still connected to the fuse. The light indicates a blown fuse. B—Load removed from fuse; light indicates good fuse. C—Load removed from fuse; light indicates Fuse No. 1 is good

Locating the "Out" Fuse

Contributed by Howard Podell

THE OCTOBER ISSUE answers a reply to E. W. who asked about locating the blown fuse on a three phase line. E. W. also inquired as to whether he should make one of the three fuses smaller than the other two, in order to be able to depend on the smaller fuse blowing on overloads. Mr. Davis in his reply gave an interesting answer but the following comments may be in order for others in the same situation.

In some cases it is possible to locate the blown fuse by an indicator in parallel to the fuse, as Mr. Davis suggests and as shown in A. Under other circumstances, a parallel indicator will not light up at all.

The parallel indicator will only light up on blown fuses when the load remains connected through the fuse. However on motor circuits, the blowing of one of the three fuses generally creates an overload on the other two fuses, so that the starter relay opens up the circuit on all three fuses and stops the motor. Under this case, no current will travel through any of the fuses and it is necessary to test in a different fashion.

B illustrates testing where no load is on the circuit. One side of the tester is connected to the load side of the fuse and other side of the tester grounded to the fuse box or other ground. This test indicates by lighting on good fuses.

When no ground wire is available, the "cross check" method may be substituted as shown in C. This test also only indicates blown fuses when the load is no longer connected to the fuse.

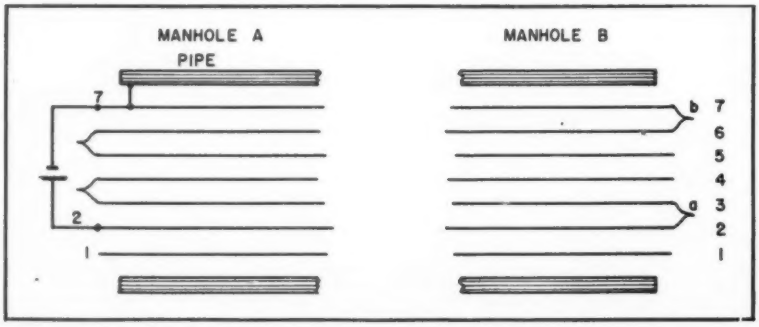
All of the above tests will indicate only when the fuse switch is "On". Testing with the fuse switch off, requires a continuity switch.

E. W. suggested making one of the three fuses smaller than the other two. However, it is not unusual on three phase circuits for the load to be unbalanced so that one of the three fuses will carry a larger current than the other two. For example, one phase can carry 100 amp with the other two carrying only 60 amp. Putting in one 60 amp fuse and two 90 amp fuses will not necessarily cause the 60 amp fuse to blow, unless it is on the heaviest line.

The important point on repeated fuse failures is to find the cause of the trouble, and that is quite a story in itself.

HOW CAN a firm watch out for hazardous cracks in vital parts of machinery? Any surface under suspicion should be soaked with kerosene, allowed to dry, and then painted with whitewash. The whitewash should be allowed to dry before giving the engine or other machine part a trial run of average duration. These cracks, if they exist, will be disclosed by the oil emerging from the crack and staining the whitewash.

DEFT FINGER work is necessary in feeding anything thin and light to machine. In one plant there is a small tin pan attached to each machine. The pan holds a rubber sponge soaked in glycerine. The operator dips his finger tips into the sponge whenever his hands become too dry for efficient feeding.



This drawing shows how J. M. Carter would solve the Brain Teaser. Mr. Carter thinks the Dodds-Ryan Methods were too tedious

New Products and Methods

WHAT'S NEW? Here industrial ingenuity is summarized for your quick review. If you want additional information or have questions on specific applications use the addressed no-obligation, no-postage card between pages 18-19 and 50-51

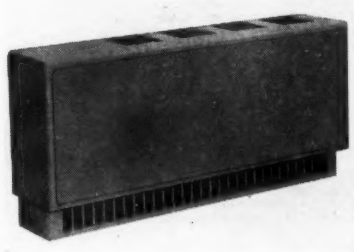
Small Steam Trap

1 A new, small steam trap in the company's steam specialties line, the No. 070 steam trap. Designed particularly to meet needs for smaller capacity steam traps, this new trap fits standard applications wherever small drainage is a problem. Available for pressures from 0 to 150 psi, this new, small trap was especially built for small drainage jobs where condensate loads are light and conditions call for the economy of an inverted bucket trap. Special features include: renewable seat—easily removed for servicing; seamless deep drawn, stainless 18-8 bucket—no welds; oversized ports—increased flow capacity; wear-resistant Anum-Metl valve and seat; and Hi-Cap orifice for greater capacity. No special

engineering experience is necessary to install this new trap and its manufacturer guarantees it against defect in material and workmanship for one year. This guarantee also covers Anum-Metl valves and seats which are guaranteed leakproof for one year. The trap was subjected to rigid field tests in its development stages. Some of the manufacturer's recommended applications include laundry and dry cleaning equipment such as pressing machines, tumblers, dryers; industrial unit heaters (up to 150,000 btu); kitchen and restaurant equipment such as coffee urns and steam tables; hospital equipment such as sterilizers and autoclaves; tire recapping equipment, and other small drainage applications. Strong, Carlisle & Hammond Co.

New Unit Heater

2 Deliveries are now being made on this new Series R unit heater. Modern cabinet design and variable fan speed adjustment make the new Series R unit heater especially suitable for a quiet office, and other such applications where low noise levels are essential. Adjusted to a higher speed, the Type R unit heater produces ideal heating capacity for any commercial or industrial application. Heating element is non-ferrous, consisting of copper tubing and aluminum fins. Element is of the hairpin circuit type, with supply and return headers on one end, and return bends at the opposite end. Suitable for steam or forced hot water circulating systems. Where desired, the Series R unit heater can be equipped with an air filter, located beneath the heating element to filter air entering the element. The new heater is available in four sizes, with one, two, three, four or five fans. Fans are forward-curved type, designed for operation at low tip speed.



Fans are supported from rubber-mounted, graphite packed sleeve bearings. The standard motor for Series R unit heater is resilient-mounted, constant speed type operating at 1725 rpm. V-belt drive with variable pitch motor sheave permits 30 per cent change in fan speed. Warren Webster & Co.

Fire Truck

3 An entirely new type of fire truck has been designed. This fire truck, the first to use dry chemical as the primary extinguishing agent, provides maximum protection for airports, oil refineries, chemical plants and other installations where severe flammable liquid fire hazards exist. Twenty-eight hundred pounds of dry chemical and 250 gal of water are carried on the truck. Fully loaded, the vehicle weighs 21,500 lb. It is 95¾ in. wide and 21 ft, 6 in. long.

Cab height is 8 ft, turret height 10 ft 6 in. This new fire truck has four wheel drive, five forward speeds and one reverse. Maximum governed speed is 62 mph, although the governor can be removed if greater speed is desired. Four extra compartments on the sides of the truck house accessory fire and rescue equipment. Ansul Chemical Co.

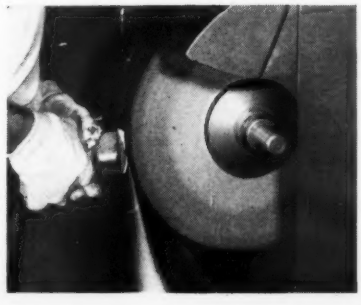
Motorgears

4 An axial air gap motor, recently announced, is now available as a motor reducer. The outstanding feature of the unit are space and weight reduction, the motor being less than half the size of the conventional type motor and weighing less by approximately one-third, yet retaining all the necessary characteristics of sturdiness and power requirements. As a consequence of its inherent design, the new motorgear with axial air gap motor, says the company, is a most compact gear motor. Available in ratings from ¾ to 10 hp, these units are symmetrical in design with no separate right-hand or left-hand assemblies. The motor may also be removed from the gear housing and run separately. This new motorgear employs two ratios of single helical gears with hardened and accurately shaved teeth arranged in simple gear trains. Another feature is that the motor and gear shafts are parallel, with the centerline of the motor coinciding with the centerline of the low speed shaft. The motor shaft

rotates on ball bearings, while the gear shafts are mounted on tapered roller bearings. The high speed pinion, mounted on the motor shaft extension close to a double row ball bearing, reduces deflection of this overhung pinion to a negligible minimum. The bearings on the low speed shaft are over-size to allow for a generous amount of outboard pull from a sprocket, gear or pulley that may be mounted on this shaft. Fairbanks, Morse & Co.

Hi-Speed Grinding

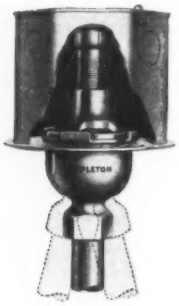
5 A new contact wheel—the first designed for heavy grinding with abrasive belts at speeds of 10,000 surface feet per minute or more—has been announced. Major advantages cited for belt grinding with the new roll, called the "K" contact wheel, are faster and cooler stock removal, lower production cost, and chatter-free grinding. It can be used at the maximum speeds of modern equipment. The combination of the high speed and the new wheel design enables abrasive belts to remove heavy metal stock faster, to perform better-finished snagging, and to eliminate frictional heat problems. Used in production for over two years in test areas, the "K" wheels have proven especially valuable in heavy stock removal, such as grinding gates and flashings on



castings, cutting down welds and grinding through scale on forgings. Minnesota Mining & Mfg. Co.

Swivel Hanger

6 Industrial lighting installations often employ the use of extra heavy fixtures which require a properly anchored swivel attachment to assure positive safety and carry the necessary weight. Type "SSH" Safety Swivel Hanger just announced, meets these conditions as the weight of the entire suspended unit is born by a fixture stud instead of relying upon the screws and screw ears of the box or ring for support. This hanger is furnished complete with a



steel plate to serve as a cover for either the 4 in. octagonal boxes or concrete rings. This hanger is supplied with either ½ in. or ¾ in. hub for pendant fixtures and the one style is supplied without the extension piece and is therefore recommended for use on 1-½ in. deep or 2-½ in. deep 4 in. octagonal outlet boxes. This same swivel hanger when supplied with an extension piece can be used on Appleton concrete rings measuring from 2-½ in. deep to 4 in. deep when these concrete rings are supplied with the regular bottom plate having ⅜ in. stud. Appleton Electric Co.

Sink Line Cleaner

7 Retaining all of its exclusive features, this new Model 600 Electro-Rod has added a number of major improvements which make it more efficient and easier to use. It embodies a new and more powerful reversible motor with new gear train mounted on hardened and ground shafts rolling in needle bearings—new ball-thrust bearings—3-conductor cord providing ground wire—new off-on switch for greater safety from shock. New patented cable container has push-button controlled tilting. A touch of the finger tilts container at any desired angle

to cleanout and has a capacity of 100 ft of ½ in. sewer cable. Cable is especially coiled and re-inforced with inner cable to withstand added torque of motor driven machines. The motor unit is easily detachable and when removed it is an excellent slow-speed drill when used with carbide tips for drilling clean sharp holes in tile, slate, mortar, etc. When used with a carborundum cutting disc and arbor bit it is ideal for cutting and removing damaged tile from walls, floors and ceilings. Spartan Tool Co.

Voltage Testers

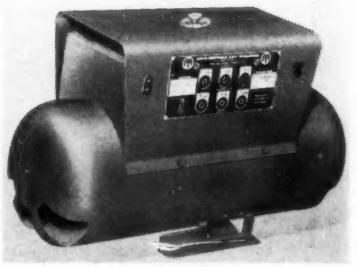
8 Two new voltage testers, one designed expressly for high frequency alternating systems and the other for the new low voltage systems, have been announced. The high frequency alternating system tester operates on systems ranging from 110, 220, 330, 440, to 550 v. ac, 400 cycles and 30, 60, 90 and 120 v. dc. The low voltage tester is designed for systems ranging from 12, 24, 36, 48 and 60 v. ac,—60 cycles to 10, 20, 30 and 40 v. dc. All the company's voltage testers have been redesigned for streamlined appearance and to provide better protection to lead wires and longer life for the unit. A new style rubber lead protector replace the old style spring guard for the test leads. The one piece fiber tester body remains unchanged, assuring extreme ruggedness and electrical protection for the user, even

under moist conditions. The sharp spear points allow the operator to pierce the insulation for voltage ratings without damaging insulation. Square D Co.

New Arc Welders

9 A new group of a-c and d-c arc welding machines have been introduced as a companion line to Murex electrodes and M & T welding accessories. A-c unit features include built-in power-factor corrector, fingertip, stepless current control; fan-forced ventilation; wide current range; moderate open-circuit voltage operation. Units are of the transformer type, available in 150, 200, 300, 400, 500 amp capacities. These units also provide instant plug-in, plug-out of electrode leads by taper-type connector. Lead interchange is avoided by a permanent work lead connection. Running gear is available where portability is required. Major design feature of all d-c models is a one dial simplified control panel. The panel carries a series of well-marked outlets, each one for an electrode of different diameter. Operator simply plugs into proper outlet, then dials for any required minor adjustment in current. Motor-driven d-c units are available in 150, 200,

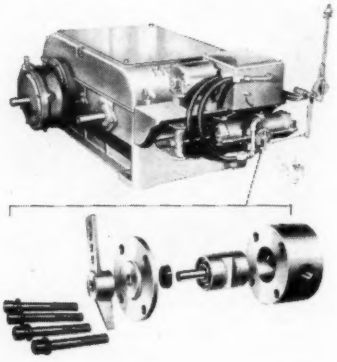
New Products and Methods



300, 400 amp capacities in new compact 3600 rpm model and in conventional 1750 rpm type. Engine-driven welders include 200 amp units powered by air-cooled Wisconsin engines, and 300 and 400 amp sets driven by Chrysler industrial engines. Metal & Thermit Corp.

Control Valve

10 A new, rotary type valve to provide maximum efficiency on hydraulic controls for Reeves variable speed transmission is now available. The new valve is an exclusive feature of the company's hydraulic control which, applied to the transmission, per-



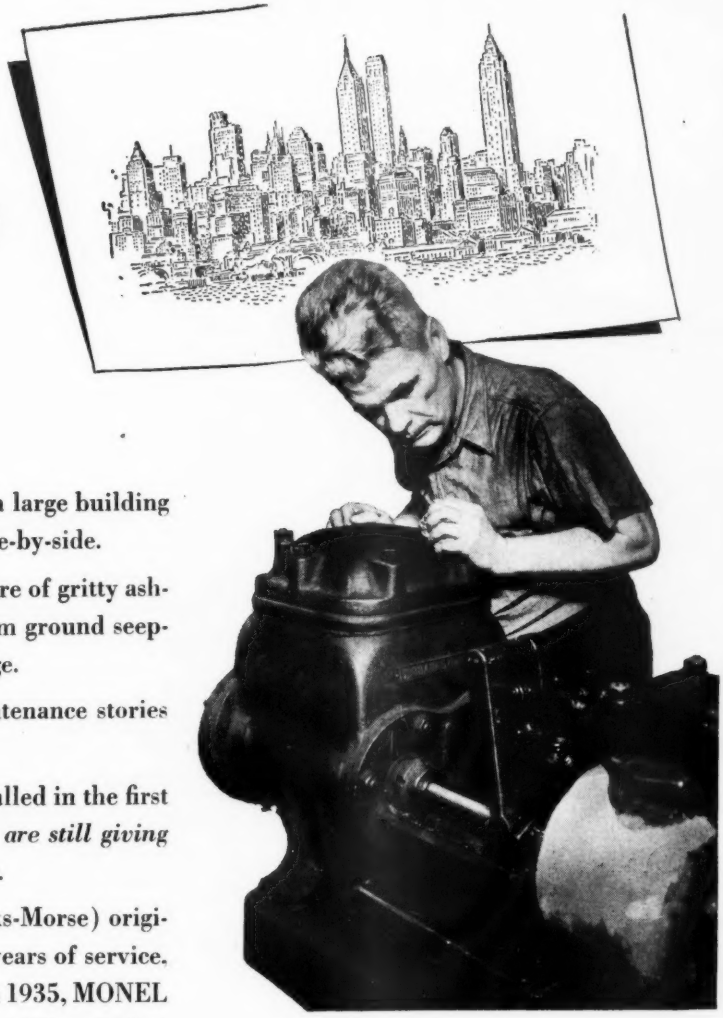
mits entirely automatic speed regulation for synchronization of different machines and separate sections of a single machine; maintenance of control tension and uniform peripheral winding speeds; and maintenance of uniform pressure, weight, liquid level, temperature and other variable elements. Extremely simple in design and with few moving parts to wear, the valve is actuated with only four ounces pressure. Its stem is mounted on ball bearings to assure smooth operation, with minimum friction or "drag". Because of its rotary design, eliminating lateral motion of the stem, the new valve can use to full advantage a tight-fitting, cup-type oil seal which prevents oil leakage around the valve stem. The new valve is being installed on all the company's variable speed transmissions, replacing the stem type valve previously used. It also is available for replacement on transmissions now in service. Only two sizes of valves are required to fit all Reeves transmissions using hydraulic controls. Reeves Pulley Co.

Paint Can Holder

11 This device consists of a specially designed top and bottom covers intended to clamp over any standard five-gallon paint container by means of three wing nuts. The base and cover assembly are made of light weight cast aluminum and comes complete with gage, regulator and safety valve. Paint outlets are designed to fit standard spraying equipment. Silver-King Corp.

(Continued on page 49)

30-YEAR OLD MONEL PUMP RODS OUTLAST OTHERS 9 TO 1



Fairbanks-Morse sump pump. The 30-year old MONEL pump rods have never been replaced or reground, show very little wear, and seldom need repacking.

In the basement power plant of a large building in New York City, two pumps work side-by-side.

Both pumps handle a sump mixture of gritty ash-quenching waters, polluted waters from ground seepage, corrosive waters from coal drainage.

Identical service...but their maintenance stories are far from identical!

In 1918, MONEL* rods were installed in the first pump, a Fairbanks-Morse. These *rods are still giving perfect service today, thirty years later.*

The second pump (not a Fairbanks-Morse) originally had bronze rods. In the first ten years of service, these rods were replaced *three times.* In 1935, MONEL rods were installed. They have been giving perfect service ever since...*for thirteen years.*

The chief engineer says of the MONEL rods: "In my opinion, they will last as long as the pumps."

This is a story worth remembering next time you need pump rods, new or replacement. For when you specify MONEL, you get a "task metal"...one that is rustproof, corrosion-resistant, stronger than structural steel, hard, tough, yet readily machinable.

If your problem involves corrosion or excessive wear of working parts, why not write to Bob Johnson of INCO? He may be able to help you find a solution.

*Reg. U.S. Pat. Off.

MONEL

...FOR MINIMUM MAINTENANCE

EMBLEM OF SERVICE

INCO

TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

Oil Company

"Without doubt, YARWAY Steam Traps are finest traps ever built. All trap replacements will be YARWAY hereafter."—Oil Company, Texas.

Cleaning Plant

"As soon as we installed the YARWAY trap our trouble ended. Since then, when other traps gave trouble, we put in YARWAYS and they always did a much better job. Now we use all YARWAY traps," says Maintenance Engineer of large mid-western cleaning firm.

Dairy Company

"YARWAY Traps have been a life-saver here. Used many different makes before trying YARWAY a year ago. Haven't touched them since. Trying to get management to buy more."—Large Wisconsin dairy.

Dye Works

"Use a good many YARWAY Traps here—like them very much on dryers. Take up little room and discharge condensate as fast as it comes through the line, causing coils to heat up faster and hold steady temperature."—Globe Dye Works, Philadelphia, Pa.

SPEAKING OF STEAM TRAPS

Laundry

"Ironer is so hot it sizzles after putting YARWAY trap on in place of a bucket trap. Run heavy spreads through ironer once and they are dry. Pulling out all bucket traps and will replace with YARWAYS."—Farina Laundry Co., Vancouver, British Columbia.

Power Station

"A great many YARWAY Traps are used here and have been very successful . . . some of these traps have been in use since 1939 and have given absolutely no trouble."—Herkimer Municipal Power Station, Herkimer, N. Y.

Florist

"Coal bill last winter was $5,000 less than previous winter. Didn't know whether they could give YARWAY Traps all the credit, but they were entitled to a big share of it."—Meyers and Santman (Greenhouses), Wyndmoor, Pa.

Hospital

"Ten years ago replaced an.....trap with a tiny ½" #60 YARWAY on an ironer. Never had such good results before. Trap has never been opened and still going 100%. Since then have bought nothing but YARWAY Traps and will specify them for new addition."—Northern Wisconsin hospital.

Textile Plant

"One large press formerly equipped with a bucket trap wouldn't heat lower platen. A ¾" YARWAY Trap was installed and since then full production has been maintained. This represents an increase of 20% in production."—Southern textile mill.

ACTUAL SIZE ½" TRAP

NEARLY 600,000 BOUGHT!

ORDER YARWAY TRAPS FROM YOUR NEAREST MILL SUPPLY DEALER. FOR NAME AND FREE TRAP BOOKLET, WRITE...

YARNALL-WARING COMPANY 145 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE STEAM TRAP

CHECK that Electrical System for ACCIDENTAL GROUNDS

Dangers of accidental grounds . . . How presence of a ground can be detected . . . Detection of grounds in d-c systems . . . Single phase a-c and low voltage three-phase methods of detection . . . Cautions to be observed . . . Short circuiting a system can be bad business

By R. LOEWE, Switchgear Section, Allis-Chalmers Mfg. Co.

NEGLECT a scratched finger and it may prove harmless; often it leads to serious trouble. Neglect serious accidental grounds on electrical distribution and generating systems and the same risk is involved.

The first ground occurring accidentally is, by itself, not harmful. If a second ground occurs, and is on a different phase or polarity, it short circuits the system. Learning as soon as possible that the first ground exists is the safe way to avoid serious troubles and shutdowns.

Spotting a Ground

The presence of a ground can be detected and indicated in various ways. Indication can be given visually by lamps or meters to show the phase or polarity in trouble. An alarm alone will not give this information. By combining the two, a remotely located alarm can give the warning while the indicating system simplifies tracing. In unattended locations this is very desirable. Maintenance and operating personnel at a distant point can learn of trouble as soon as it occurs. Once their attention is gained, they can check the indicating system to locate the grounded line.

Ground detection systems vary greatly in cost and complexity. The selection depends on the amount of information required, and the reliability and type of system, and the number of phases if alternating current is involved. The system should be as simple as possible with a minimum of parts involved for trouble-free operation and easy maintenance.

In general practice, two or more lamps or voltmeters are used to show the magnitude of line to neutral voltages. A ground will unbalance the two voltages and reveal itself; the degree of unbalance will indicate how solidly the system is grounded. Many grounds start with relatively high resistance but as time passes, it may drop to much lower and dangerous values.

A system of this type will enable an engineer to predetermine, in effect, the degree of accidental ground that can be tolerated before action must be taken. In some cases this can be valuable information.

Most of the common methods for ground detection and some of the more uncommon ones are shown in the accompanying drawings. They are arranged by methods under the type of power system to which they apply. The symbols used in Figs. 2 to 4 are shown in Fig. 1.

For d-c Systems

Several schemes for direct current systems are found in Fig. 2. Methods A, B, C, and D use two lamps, each lamp must be rated for the total line-to-line voltage. Normally they will glow with very subdued brilliancy because each will have half of the normal voltage across it. The midpoint between lamps is grounded either directly or through a pushbutton. With method A, a ground will be indicated by one lamp being dark and the other at normal brilliancy; the dark lamp indicates the grounded polarity. In B, a ground will be revealed in the same way when the button is depressed. Method C is the same as A except that it is possible to see if a lamp has failed or if a ground actually exists. Depressing the button should cause both lamps to glow dimly if the system is not grounded. In D, a double contact button is used; both lamps are then normally dark.

Voltage relays are used in methods E and F to operate a remote alarm. Both relays have equal voltages when the system is ungrounded. In E, the relays are overvoltage relays. A ground will apply line-to-line voltage across the relay connected to the ungrounded line, closing its contact to ring the alarm. Method F uses undervoltage relays. A ground will cause the relay connected to the ground line to lose its voltage, close its contacts and ring the alarm.

Visual indication is provided by voltmeters in G and H. In G, both will read half of the line-to-line

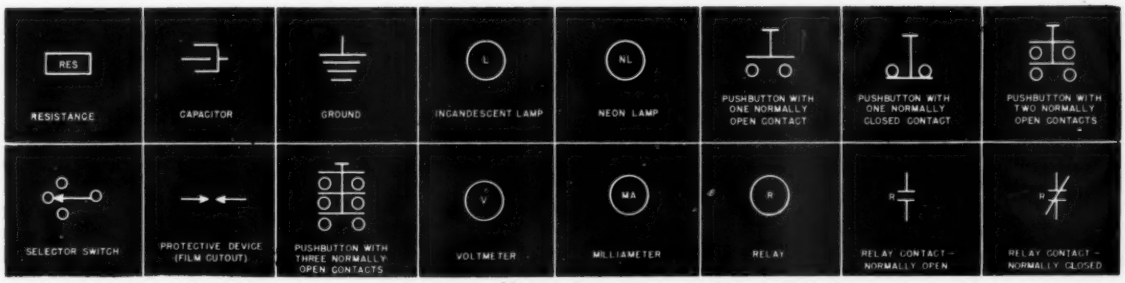


Fig. 1. The various symbols used in the following drawings are explained here

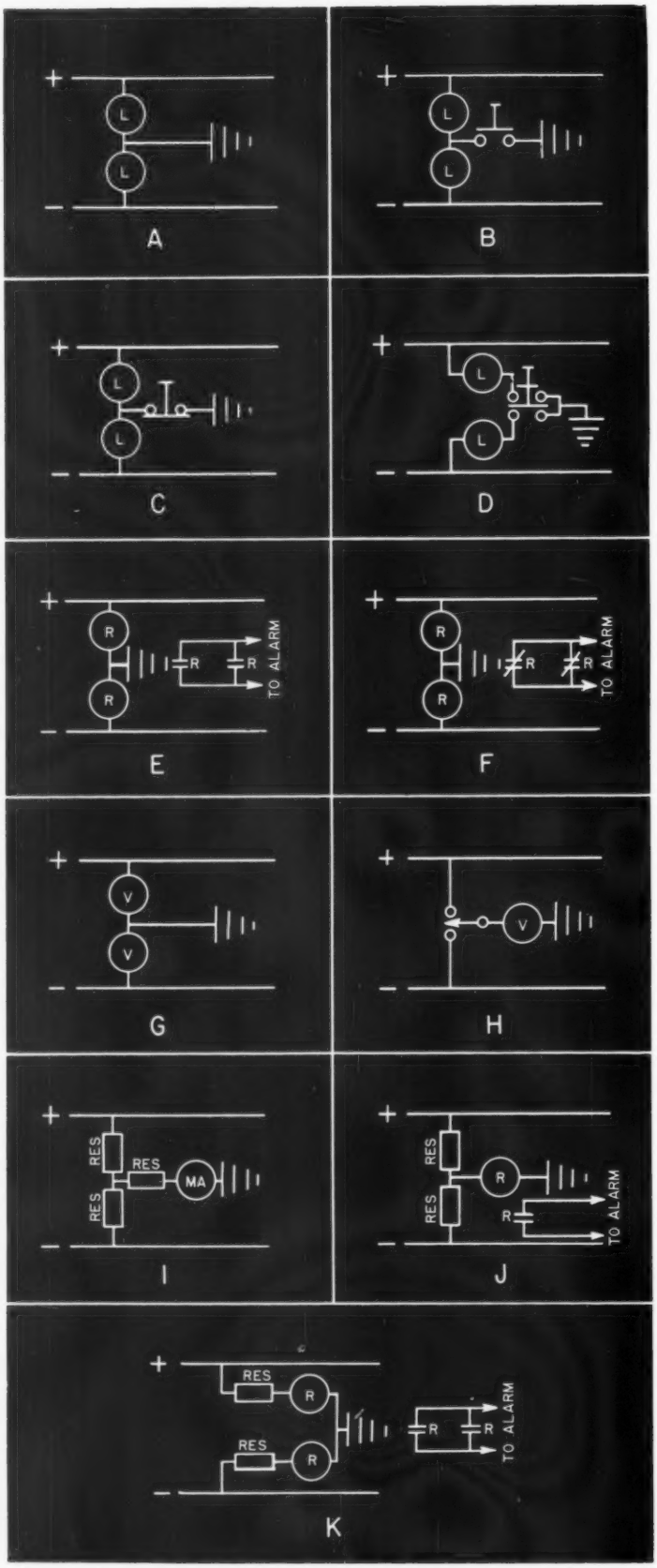


Fig. 2. Ground detector diagrams shown in this drawing represent several variations suitable for low voltage, direct current applications. These applications are the simplest for this type of system.

voltage. When a ground occurs, the meter on the grounded line will decrease and the other increase. Method H has only one voltmeter. No reading is obtained until the system is grounded. Switching from one line to the other will reveal the grounded line because of its lower reading.

A flow of ground current is detected by a milliammeter in method I but not the polarity grounded. To protect the meter against excessive current, resistors large enough to limit the current through the meter to a safe value must be put in series with the meter.

Methods J and K have current sensitive relays to operate an alarm. In J, a relay replaces the meter of method I and sounds the alarm but does not indicate the polarity. With K, two similar current relays with their contacts in parallel give the alarm. The pickup point for the relays must have less current than that which normally flows through the two in series when no fault exists. With a ground, the relay connected to the unfaulted line will close and ring the alarm.

Single Phase a-c Methods

The various methods for ground detection on single phase alternating current systems are given in Fig. 3. Methods A to K apply and perform in the same way as outlined for application to direct current systems. In L, M, N, and O, static capacitors are used for coupling devices and as voltage dividers instead of resistors. Method L has a milliammeter to indicate the existence of a ground but not the grounded line. In M, two neon bulbs are added to L to indicate the ground. The bulb on the grounded line will be dark, the other will be at full brilliancy. Method N replaces the milliammeter in L with a current sensitive relay to sound an alarm without indicating the faulted line. Method O is the same as N except that neon bulbs are used to indicate the faulted line.

Low Voltage 3-Phase

Figure 4 shows the methods of Fig. 3 extended to three-phase alternating current systems under 600 v; the same comments apply.

These many suggested methods may lead to other variations. From their division according to the type of power system and the number of phases, additional combinations can be derived with a little ingenuity to meet any requirement for ground detection on normally ungrounded systems.

Where the choice must include an alarm, a relay, either current or voltage, must be in the system selected. Indication of the faulted line can be provided by lamps or voltmeters. Lamps are less positive because if one should burn out, the results would be erroneous. Voltmeters offer a more accurate indica-

tion both of a fault and the degree of grounding. Where cost is not too important, they are the more desirable. Voltmeters can be standard or have special scales marked to indicate the voltage range of the ground.

When coupling condensers are used, they may be either standard capacitors or made up of a layer of foil embedded in a standard section of bus insulating tubing of the type used in high voltage metal-clad switchgear.

Some of the methods that have been discussed have obvious limitations. But by studying the circuits and their explanation, the power system operator should be able to make a satisfactory choice for this particular system and needs.

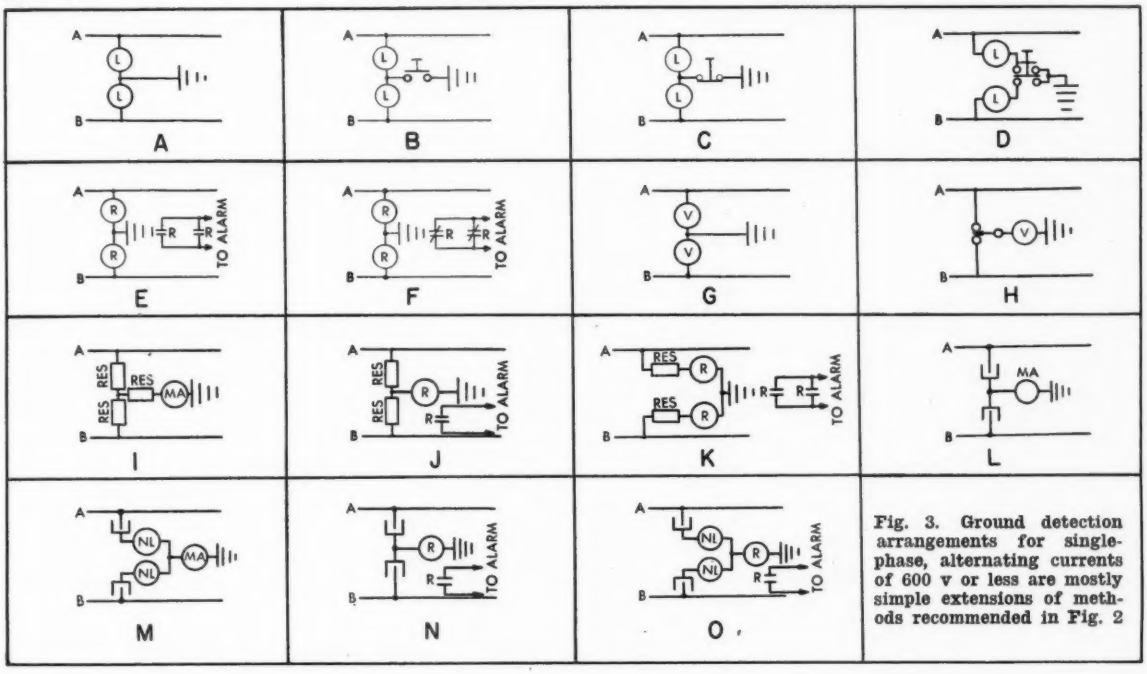


Fig. 3. Ground detection arrangements for single-phase, alternating currents of 600 v or less are mostly simple extensions of methods recommended in Fig. 2

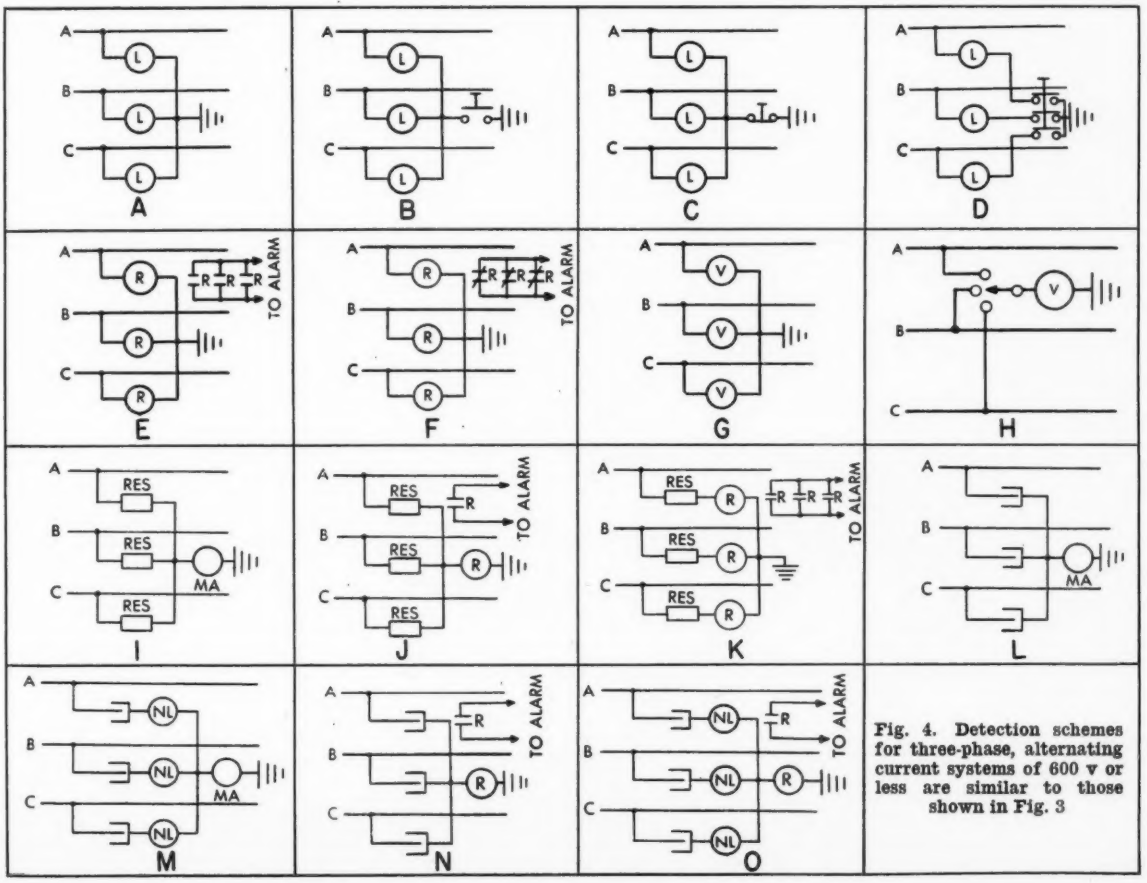


Fig. 4. Detection schemes for three-phase, alternating current systems of 600 v or less are similar to those shown in Fig. 3

Watch Those Belt Drives!

Pulley and sheave sizes have everything in the world to do with efficient and effective belt drives . . . Good examples of bad pulley and sheave sizing are described here . . . Tables of American Leather Belting Assn. can be used as guide in selection of proper pulley and belt sizes

By **HERBERT BOUTON**

FULLY 95 PER CENT of the plants that the writer has visited in many years of active engineering work have been excellently run. Perhaps this very fact makes the poorly-operated plants seem, by comparison, much worse than they are. Mechanical power transmission practice may vary widely and it is in this phase of plant operations that many weaknesses show up.

One horrible example which I noticed recently was in a tire plant. Four machines were used for wrapping paper tape around the finished tires. All of them were driven from an overhead line shaft which was powered by a belted motor in the usual manner. When each tire wrapping was completed it was necessary to stop the wrapping machine so that the tire could be removed and another tire placed on the machine.

Table I. Belt speeds in feet per minute for different pulley diameters and speeds in rpm

Pulley Diam., Inches	FULL LOAD MOTOR SPEED							
	3490 RPM	1750 RPM	1150 RPM	850 RPM	690 RPM	575 RPM	490 RPM	435 RPM
2½	1324	687			BELT SPEED F. P. M.			
2	1906	916	602					
2½	2257	1148	753					
3	2708	1374	903	667				
3½	3160	1603	1054	779	632			
4	3611	1832	1204	890	721	602		
4½	4062	2062	1355	1001	810	677		
5	4514	2291	1506	1113	902	752	642	
5½	4965	2520	1656	1224	992	828	706	
6	5417	2749	1806	1335	1082	903	770	684
6½	5868	2978	1957	1447	1171	978	834	741
7	6319	3207	2107	1558	1261	1054	899	798
7½	6771	3436	2258	1669	1351	1129	963	855
8	7222	3665	2408	1780	1441	1204	1027	912
8½	7674	3894	2559	1892	1532	1279	1091	969
9	8125	4124	2709	2003	1622	1355	1155	1026
9½		4353	2860	2114	1712	1430	1220	1083
10		4582	3010	2225	1802	1505	1284	1140
10½		4811	3161	2337	1892	1580	1348	1197
11		5040	3311	2448	1983	1656	1412	1254
12		5498	3612	2670	2161	1806	1541	1368
12½		5727	3763	2782	2256	1881	1606	1425
13		5956	3913	2893	2342	1957	1669	1482
13½		6185	4064	3004	2435	2032	1733	1539
14		6414	4214	3116	2522	2107	1797	1596
14½		6644	4365	3227	2617	2182	1862	1653
15		6873	4515	3338	2706	2258	1926	1710
15½		7102	4666	3449	2800	2333	1990	1767
16		7331	4816	3560	2882	2400	2054	1824
16½		7560	4967	3672	2973	2484	2118	1881
17		7789	5117	3783	3062	2550	2182	1937
17½		8018	5268	3895	3168	2634	2247	1994
18			5418	4006	3248	2710	2311	2051
18½			5569	4117	3338	2785	2375	2108
19			5719	4228	3422	2860	2439	2165
19½			5870	4340	3518	2936	2503	2222
20			6020	4451	3606	3011	2568	2279
21			6321	4673	3793	3161	2696	2393
22			6622	4896	3968	3312	2824	2507
23			6923	5118	4180	3462	2953	2621
24			7224	5341	4330	3613	3081	2735
25				5563	4539	3706	3210	2849
26				5790	4700	3917	3338	2963
27				6013	4861	4068	3466	3077
28					5062	4218	3596	3191
29					5243	4369	3723	3305
30					5423	4520	3851	3419

Then the wrapping machine was accelerated to full speed.

These acceleration demands, often repeated, threw a heavy load on the main motor belt driving the line shaft and the belt was unable to handle the load. Most of the motor's power was expended in screeching and whining of the belt as it attempted to accelerate to full speed. It took only a few minutes time to find out that the pulleys were much too small for the demands placed on them.

Use Recommended Sizes

There is no excuse for any mechanic or foreman being unable to find out what size pulleys should be used on given motor drives. The Engineering Committee of the American Leather Belting Assn. lists recommended pulley sizes which are the smallest diameters that should be used to obtain given belt speeds in fpm at various motor speeds.

Nearly all unsatisfactory belt drives get that way because one of the pulleys—usually the driving pulley, is too small. Therefore, the first step toward getting a good drive is to select a driving pulley large enough for the job. The slower a belt runs the tighter it must be kept and the tighter it is the more pressure is put on the bearings. There is, consequently, more rapid belt stretch. So, if small pulleys are used, then wider belts and higher bearing pressures will be required and difficulty may be encountered through bending of the motor shaft or heating in the motor bearings.

Small pulleys do not have as much leverage over their loads as do the larger pulleys and the belts as a consequence are more likely to slip at starting or under heavy load. This is what was happening on the tire wrapping machines. It stands to reason, therefore, that good practice would call for the use of pulleys larger, if practical, than the ALBA recommendations. The accompanying Table I shows belt speeds in fpm for various pulley diameters and rpm.

Analysis of the belt on the tire wrapping machine showed the belt to be a 4-ply canvas, 6 in. wide belt operating at around 2700 fpm, far too slowly to give the best results. New pulleys, which would give approximately 5000 fpm belt speed, and an endless double leather belt were specified. This speed was crowding the high side just a bit but the load on the belt at periods of acceleration was so heavy that the high belt speed was considered justified.

Following a test run of two weeks the set-up was again inspected. The combination of a sufficiently heavy belt, and pulleys which were large enough to produce the desired belt speed, had resulted in an output which tripled that preceding the change.

Another misapplication of belts was found in the same plant. A few small machines in one room were set up to drive from an overhead line shaft which was powered by a motor driving the shaft through a flat belt. The set-up, as originally designed and installed, was good, but when more machines had to be added another line shaft was installed and cross-belted to the first line shaft. There was no good engineering reason for this other than a mistaken idea that some sort of economy would result if a new motor were not installed. To make matters worse the entire job was engineered, and I use the term loosely, by a foreman who must have depended completely on his intuition. The drive belt from the first line shaft to the second one paralleling it was doing its best but its best wasn't good enough. It was shrieking and slipping and was off the pulleys more often than it was on. Analysis of the drive showed it was running a belt speed of around 1100 fpm on 14 in. pulleys mounted on each shaft. As the motor had ample capacity and as the final speeds of the production machines were right it was easy to see that the fault lay with the size of pulleys.

Get High Speed

In this department there was sufficient clearance to double the size of the pulleys so 28 in. pulleys were installed on both shafts thereby increasing the belt speed to 2200 fpm. Had the demand been any greater it would have been necessary to install a separate motor for each shaft because the ceiling clearance could not have stood pulleys of much greater diameter. According to the American Leather Belting Assn.: To figure a belt drive from either a line shaft or an engine or for any purpose other than a direct electric motor drive choose a driving pulley

with a diameter which will give as high belt speed as possible—from 3500 to 4500 fpm. This is the safe way to get a drive that will perform well and be cheaper, because narrower belt and pulleys can be used.

Within reasonable limits and ignoring the effect of centrifugal force, doubling belt speed doubles the horsepower a given belt will transmit, or cuts in half the stress in the belt for the same horsepower. Having determined suitable motor or driving pulley for your job and knowing the belt speed, the next step is to determine the proper thickness of belt. The diameter of the smallest pulley in the drive determines the belt thickness. This is important. The smaller the diameter of the pulley around which the belt bends the quicker the belt will wear out. So belt thickness depends on the diameter of the small pulley. The figures given in Table II show minimum recommended pulley diameters for various belt thicknesses.

Table II. This table can be used as a guide for selecting belts of correct thickness for various widths of belts and diameters of pulleys

	SINGLE PLY		DOUBLE PLY			TRIPLE PLY	
	Med.	Heavy	Light	Med.	Heavy	Med.	Heavy
	These are the minimum recommended pulley diameters for the above thickness belts						
Belts Under 8" Wide	3"	5"	6"	8"	12"		
Belts 8" and Wider			8"	10"	14"	24"	30"

Another example of bad application of a belt drive was observed in a woodworking plant. Here a heavy surfacer or planer was flat belted to a 60 hp motor. The pulleys were located at the center of the 16 ft shafts. The 12 in. heavy double ply belt was nearly worn out but at top speed it seemed to be adequate if kept tight. At starting moment, however, the whole set-up was so inadequate that the motor often stalled; generally the crew had to help the motor get the pulley started.

Upon checking replacement costs for a new belt it was found that a new set of V-belts and sheaves, properly engineered for the job, plus the cost of re-setting the motor would be less than the cost of replacing the old flat belt. The sheaves were very nearly the same size as the old pulleys but, when the drive was started on its initial run it started so noiselessly that the operator had to turn around to make certain it actually was in operation.

Where the old belt had to be kept so tight that the tension would stall the motor the V-belts could be run at decreased tension due to the fact that the V-belt and sheave utilize the principle of "wedge action." Thus the pressure of the belt tension on the bearings was relieved and the motor was able to start the load.

Most of the manufacturers of flat and V-belts publish, and distribute entirely free of charge, engineering handbooks designed to aid the user in choosing proper drives. I know quite a few millwrights and foremen who could use these handbooks to advantage. In many plants it is a common sight to see an otherwise excellent V-belt drive running with the belts so loose that it was hard to understand what kept them in the sheaves. This practice permits slippage and resultant poor power transmission and rapid wear. Pivoted motor bases, of course, would automatically have prevented this but all that was necessary, in the instances noted, was to have backed the motor up a bit on its slides in order to tighten the belts to correct tension.

Another bad practice in handling V-belts is to replace only the individual belts, in a multiple V-belt drive, that were showing signs of wear. All strands should be replaced when part of the belts have worn out.

Otherwise the set is badly mismatched and when tightened up only a portion of the set will be performing its job. The rest of the belts will just be "going along for the ride." The result is rapid wear on the new belts that are pulling the load and the situation is soon as bad as before. If one strand of a V-belt fails, common practice is to let the rest carry the load until more of them reach the fatigue point; then the entire set is replaced.

One of the worst examples of power transmission mis-application due to lack of common sense or experience was noted recently. A chain drive running quite slowly on a heavy machine in a foundry failed because of too-long service. The drive finally pulled what was left of the small sprocket teeth entirely off the sprocket rim. One of the young engineers, cocky and self-confident, was in charge of maintenance in that section of the plant. He had heard of the good results obtained from V-belt drives and decided to try V-belts in its place.

Blithely disregarding all such details as speeds of the chain or belts, he instructed the millwrights to take off the sprockets and replace them with two "B" section sheaves and V-belts. The foreman properly protested but was overruled by the youngster and the belts and sheaves were rigged up to run at the same speed as the chain drive. The foreman had his brief moment of satisfaction when the starting switch was thrown and a big motor pulled those two little V-belts in two without even moving the shaft of the machine they were supposed to be driving at full load. The red-faced young engineer quickly gave orders to replace the original drive.

Fork Trucks on a Holiday

Contributed by Clark Equipment Co.

Spectators at a recent sport event in Michigan witnessed a sight which might well be repeated at other outdoor sports events in the future — radio broadcasting from the top elevation of an industrial fork truck. The machine used was a standard model truck needing only the addition of a pallet-type platform for the announcers. As a mobile studio, lowered or raised at will, quickly maneuvered from one vantage point to another for interviews and unobstructed observation, the arrangement proved a natural, according to its sponsors

Make Your Inquiries For Centrifugal Pumps Complete

Part II* Factors which must be considered when making a centrifugal pump installation . . . Suction and discharge conditions . . . Load factor . . . Axis of rotation . . . Driving source or power . . . Space and weight limitations . . . Transport facilities . . . Location of installation . . . Special vs. standard equipment . . . Special requirements due to experience or local conditions . . . All have a bearing on the final selection

By IGOR J. KARASSIK and ROY CARTER,
Application Engineers, Worthington Pump & Mach. Corp.

PART I DISCUSSED 1. the number of units required, 2. the nature of the liquid, and, 3. the required capacity on the selection of the proper centrifugal pump for a given application. Part II will complete the analysis of additional factors[1] which must be determined before an inquiry for the required centrifugal pumping equipment is prepared.

4. Suction Conditions

Importance of correct suction conditions[2] for a centrifugal pump installation cannot be over-emphasized. Unless the available net positive suction head, NPSH, is equal to or in excess of that required, the pump would be unable to meet its capacity design conditions and damage would befall the pump from the resulting cavitation. Figure 5 shows how suction lift affects capacity and efficiency.

If cold liquids are handled, it is therefore, necessary to know whether there is a head on the suction or whether the pump will operate on a suction lift and if the latter, what will be the maximum lift. In the event that the liquid is hot or under a pressure corresponding to or near its vapor pressure, the pump must be installed with head on suction and the available submergence must be made known. In all cases, it is advisable to determine separately the static difference between the liquid level and the pump centerline and the friction and entrance losses in the suction piping. If these losses have not been determined, it will generally suffice to describe accurately the suction layout, listing all lengths, pipe sizes and valves.

5. Discharge Conditions

Discharge head for the design conditions should be stated with the understanding that it is generally composed of static elevation (or pressure) and frictional losses in the discharge piping and that any variations in the static head must be known in order to determine the maximum and the minimum head against which the pump is to operate.

Specifying an excessive total head has actually the same effect as specifying excessive capacity. Since a centrifugal pump will always operate at the intersection of its head-capacity curve and of the system-head curve a pump which develops an excess of head will, unless artificially throttled, deliver capacity in excess of that desired. That is, its curve will intersect the system-head curve at a greater flow.

By breaking up the discharge head into static and friction head, we are also able to tell whether the friction losses are excessive. If the piping to be used is too small, the required pump and its driver will be more expensive than necessary and the cost of operation greater than if the proper size pipe was used.

When the total cost involved is high and justifies an extremely detailed analysis, it is possible to determine the most economic size of pipe by plotting the sum of the amortization of initial pump, driver and piping cost plus the operating cost versus pipe sizes.

In certain special applications, the pump may be required to develop, for short periods, discharge pressures in excess of the design conditions. A typical example is a condenser water circulating pump which is to be installed in a system utilizing a syphon effect. The head to be developed consists only of the frictional losses through the piping and through the condenser itself and is therefore of fairly low magnitude. However, in order to enable the condenser circulating pump to deliver water through the condenser, it is necessary to prime the system, in other words, to discharge water over the syphon. The design of the pump must be such as to permit it to develop a head at shut-off considerably higher than the normal operating head.

In some condenser circulating pump installations, the head required before the syphon is established might so affect the characteristic curve which must be developed that the normal operating head occurs at a point of the curve

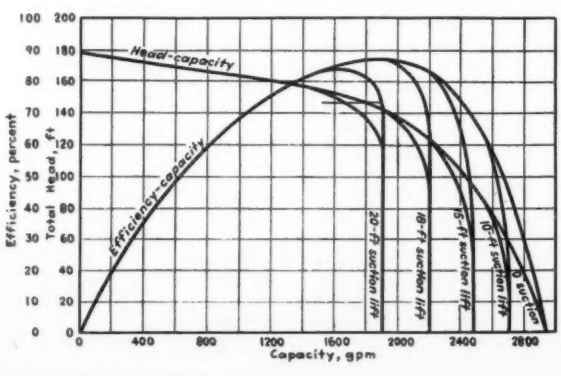


Fig. 5. When the suction lift against which a pump operates exceeds a given value both capacity and efficiency are affected

* This is Part II of a three part article. Part I appeared in the November issue of PLANT ENGINEERING. Part III will appear in a subsequent issue. Republication rights reserved by the authors.

[1] See Table I, Part 1, page 24 in the November issue of PLANT ENGINEERING.

[2] See Match or Misfit? The Centrifugal Pump vs Its System by Roy Carter and I. J. Karassik, PLANT ENGINEERING, March, April and May 1948.

where the pump efficiency is relatively poor. However, in a syphon system it is generally possible to eliminate the higher starting head requirement by incorporating a vacuum producing device.

This device is connected to the top of the syphon, so that the air at the high point can be evacuated and the syphon established with the pump producing a head no greater than that required for normal operation. In many other cases, a little study or the installation of relatively inexpensive additional equipment will often simplify a problem of this nature.

6. Load Factor

Expected load factor of the contemplated installation will play an important part in the selection of the best pump to be used. We have

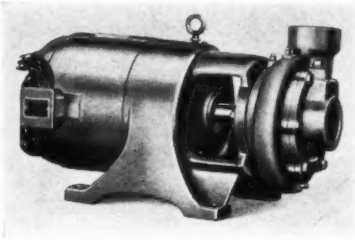


Fig. 6. Space saver, a close-coupled pump with pump and driver on a common shaft

already seen in the preceding article how it may affect the number of units which will best answer the capacity requirements. In addition, if the service is intermittent, it is unnecessary to use the most efficient pump available, the selection being generally made on the basis of least first cost. On the other hand, a pump intended for continuous service should be selected on the basis of efficiency, reliability and long life.

7. Axis of Rotation

While the majority of centrifugal pumps are horizontal units, there may be encountered conditions where a centrifugal pump with a vertical axis of rotation will prove to be more suitable. Axial-flow propeller pumps and certain mixed-flow type pumps are frequently arranged for vertical operation. This results in a very compact installation and permits to locate impeller under submergence so that the pump is always primed. At the same time, the motor driver can be placed above the pump at a level sufficiently high to avoid accidental damage to the driver should the water level rise excessively. Sewage pumps of large and small size are also frequently installed in this manner.

Vertical pumps can be arranged either for wet or dry pit installation. Since the types of pumps used for these two categories are quite different, it is very important to determine which of the two installations is required.

8. Characteristics of Driving Power

While modern centrifugal pumps are usually driven by electric motors, steam turbines or internal combustion engines, there are a great number of other types of drives as well as means of power transmission.

A centrifugal pump may be driven by: 1, electric motor, 2, steam turbine, 3, gasoline engine, 4, diesel engine, 5, water turbine, or, 6, gas turbine.

The driver may be connected to the pump by means of, 1, direct drive through a coupling, 2, flat belt or multi-V-belt drive, 3, gear, 4, hydraulic coupling, or, 5, magnetic clutch or coupling.

Finally, a centrifugal pump may be operated either: 1, at constant speed or 2, at adjustable speed.

A centrifugal pump, its drive and its method of operation should form an integral and harmonious unit. The specific application and service to which the pump is intended will dictate not only the choice of the pump itself but of its driver as well.

The electric motor is by far the most common type of driver for centrifugal pumps because electric power is usually the most economical and available source of energy. When steam is available at a lower cost than electric power, a steam turbine might be preferred. In many cases, standby pumps are turbine driven as a protection against electric power failure. In some instances, the exhaust steam from the turbine is used for process work or for heating and thus the turbine acts as a reducing valve to produce low pressure steam.

Gasoline engines are used to drive centrifugal pumps mainly where there is no adequate electric power supply or where protection is required against failure of the electric power supply. Many dual driven centrifugal pumps are fitted with an electric motor at one end and a gasoline engine at the other to take care of economy and absolute reliability, respectively.

Where the speed of the centrifugal pump is low and the horsepower consumption great a Diesel engine is often used in place of a gasoline engine. Diesel engines are more economical than gasoline engines but have a higher first cost. Low head drainage and irrigation pumps handling large quantities of water, require slow speed centrifugal pumps, and large power input thus making the Diesel engine an excellent driver.

Water turbine drives have a limited application where a large supply of water is available as a cheap source of energy. As to gas turbines, their use is still extremely limited, but indications are that it will grow rapidly as the art of gas turbine design progresses.

Direct connection between a pump and its driver is generally preferred. However, centrifugal pumps are frequently belt driven when it is necessary or desired to use a driver, such as an engine or electric motor, having a rated speed other than that required by the centrifugal pump. Such an arrangement is also used when space requirements make it impossible to connect the pump and its driver in tandem and when they must be mounted alongside of one another.

Gear drivers are used to step the driver speed up or down for the same reasons that belt drives are used. Thus for instance, gears are frequently used with turbine drive in order to retain the high speeds conducive to low turbine water rates regardless of the low speed that may be required at the pump. On the other hand, it is quite common to use a separate gear between a Diesel engine and a centrifugal pump in order to step up the relatively low speeds of these engines.

Hydraulic and magnetic couplings are mainly used in order to obtain variable speed at the centrifugal pump while operating the driver at constant speed.

9. Space and Weight Limitations

It is sometimes necessary to install a pump in cramped quarters. Vertical pumps may be preferred in such cases, as they take up only a small fraction of the floor space required by a horizontal pump of equal capacity. As an alternate, is is possible to select a pump operating at

Fig. 7. When a horizontal pump suction nozzle points vertically downward it is called bottom-suction pump

the highest speed compatible with the conditions of service, since this also serves to reduce space requirements. Although the use of close-coupled pumps, Fig. 6, was introduced primarily from consideration of first-cost economy, the application of such pumps presents definite

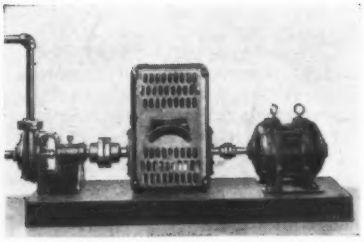


Fig. 8. Wide pump variation may be obtained by means of a variable speed drive between the pump and a constant speed motor

space-saving advantages. Finally, in a number of cases, the use of horizontal pumps with bottom suction, Fig. 7, may simplify considerably the problems of spacing and suction piping accommodation.

In general, the weight of the pump is a matter of no special importance but aboard ships, for instance, light weight is a deciding factor. For this reason, it is the practice in Navy and Merchant Marine installations to use extremely high speed units of special design, operating at speeds up to 7500 rpm and generally turbine driven. The pump design itself is directed towards the elimination of excessive weight through the use of lighter but stronger materials and the cutting away of all metal which can be dispensed with.

Facilities available for transportation should be outlined if there is anything unusual about them. Sometimes it is a long journey from the factory where a pump is built to the place where it is needed. It may be that over a part of this journey the transportation facilities are poor. Cases arise where horses and mules must be depended upon and where all freight must be carried on pack saddles. For transportation over such routes, pumps must be supplied light in weight and of sectionalized construction so that no single part is too heavy for horse or mule back.

In other cases a pump must be brought to its ultimate destination through tunnels or shafts of limited dimensions and the pump selection must be made with such restriction in mind. All such limitations must be carefully listed lest a pump fully built and delivered part way prove to be undeliverable.

10. Location of Installation

The geographical, as well as immediate location of the installation has a great bearing on proper pump selection and on its maintenance.

The elevation above sea level affects the pump in that there is a decrease in atmospheric pressure of about 1 in. of mercury per 1000 ft of elevation. At an elevation of 4000 ft, therefore, the atmospheric pressure is 4 in. mercury or about 4.5 ft less than at sea level. This means that a centrifugal pump can handle 4.5 ft less suction lift than at sea level.

Geographical location must also be taken into consideration when spare parts are to be recommended, since a pump which is to operate in an out-of-the-way place should be supplied with sufficient spares to avoid interruption of service if parts become worn and cannot be readily replaced.

Immediate surroundings of a pump will affect the accessibility after installation. A pump located in a cramped or dirty and wet, or poorly lighted position will surely be neglected by the operators, will not give satisfactory service and will be difficult to inspect, dismantle and repair.

11. Special Requirements

This factor must perforce cover a multitude of sins. It is highly important that the pump manufacturer be made familiar with any special requirements and preferences of the personnel who is going to operate the centrifugal pumping equipment. Some of these preferences may be based on insufficient knowledge of the most modern practices, but they may as likely originate from experience with pumps operating under the same conditions that the new pumps will have to meet. Much valuable information may be made available to the pump manufacturer, information which will enable him to furnish that type of equipment which will give the longest and most reliable service.

Customer's recommendations however, should be limited to the user's experience with pumps operating under similar conditions rather than form a list of his preferences, lest such preferences result in the purchase of very special equipment. Whenever the manufacturer's standard construction can be used, it is preferable to specially built units, both from the point of view of the original cost and from that of obtaining repair parts in later times.

In addition, it is necessary to take into serious consideration the expected ultimate life of the installation. If the design and materials of construction of the centrifugal pumping equipment are selected on a life expectancy much in excess of

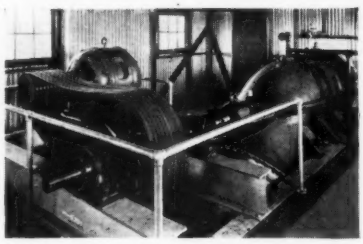


Fig. 9. A large propeller type pump driven by an electric motor through a V-belt drive

the life expectancy of the process or installation for which the equipment is intended, the original cost of the latter will be out of proportion. In other words, while it is a short-sighted policy to purchase equipment with a twelve month life for an installation designed to last fifteen years, it is just as wasteful to buy a pump to last twenty years if a temporary six month use only is contemplated.

Underground Steam Line Protection

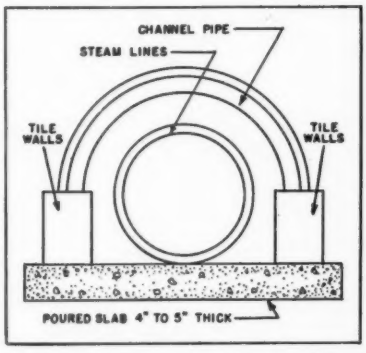


Fig. 1. The cross-sectional diagram shows how engineers of the Birmingham Electric Co., Birmingham, Ala., use clay channel pipe to protect and insulate underground steam lines

Fig. 2. This photo shows how the chemical-resistant channel pipe is grouted with mortar to structural tile sidewalls set on a poured base. This forms a tunnel for the magnesium jacketed steam lines. Dampness from the earth is warded off by the clay pipe and it can quickly and easily be removed to provide quick access for repair or inspection of the steam lines

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"They warned me in Production that I might meet some opposition to my ideas"

Maintaining Industrial Lighting Efficiency

By CARL THOMAS

THE SUBJECT of artificial lighting in industrial plants has received too little consideration. During the war years a number of plants were newly built or enlarged, and, in general, such new construction did receive the benefit of modern lighting engineering, and this doubtless contributed much to the high production rates prevalent in such plants. But the bulk of America's industrial buildings were erected prior to the war, and, in many cases, are inadequately and inefficiently illuminated.

Studies show that footcandle requirements, based upon the fundamental principles of eyesight conservation and seeing comfort, are approximately as follows: In areas where intermittent tasks are carried on, such as cement and clay products grinding, stone crushing, hand furnaces and boiling tanks in chemical plants, stockrooms for medium size materials, and loading docks, 5 footcandles. For such work as moulding cement and clay products, glass blowing machines, steel rolling mills, and stockrooms where small articles are handled, 10 footcandles. Where tasks such as rough bench and machine work, medium assembly and inspection, hand painting, and weaving light woolens are carried on, 20 footcandles. For severe seeing tasks, such as medium machine work, medium fine assembly and inspection, fine sanding and woodwork finishing, and drafting and proofreading, 50 footcandles.

Very exacting and prolonged seeing tasks, such as fine bench and machine work, very fine hand painting, finishing, and discrimination of fine detail of low contrast, 100 footcandles. Extra fine inspection, as required in making precision instruments, requires 200 footcandles. Where industrial color identification is necessary, 500 footcandles is required. And some very critical seeing tasks may require an even higher level of illumination. While some of these lighting levels may seem unusually high, their necessity can be better understood when it is realized that the level of bright summer sunshine is 10,000 footcandles.

When we see an object, it is the light reflected from the object that we actually see. For this reason, brightness, which is the amount of light reflected from an object, is an important factor in seeing. For example, a piece of gray paper having 8 per cent reflection factor will require 10 times as much illumination as a piece of white paper with 80 per cent reflection factor, in order for each to be equally visible. Therefore, the darker the object the more illumination it will require.

Size is another important factor in seeing. The larger an object is, of course, the easier it is to see. But by increasing the illumination level the apparent size is increased, and seeing becomes easier. For this reason, fine work requires more illumination than coarse work.

A further factor in seeing is the time required to see. It has been

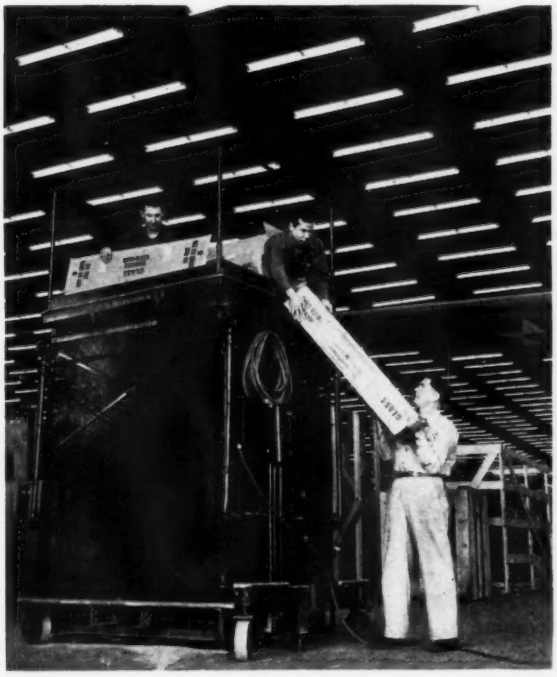


Fig. 1. Left: A service crew at a California aircraft plant loading the telescopic platform with new lamps for servicing lighting system. This electric-driven platform speeds relamping and servicing in high bay areas not served by overhead lamping bridges which travel on existing crane rails. Fig. 2. Right: Clamp-on brackets attached to ladder give a workman extra arms for greater efficiency

proven that the speed of seeing increases with increase in the level of illumination. Therefore, tasks which depend upon speed of vision should have high level illumination for maximum efficiency and safety.

Due to the complexity of a complete program of efficient seeing, it is important that the planning of lighting systems and light reflecting painted surfaces be entrusted to experienced lighting and color engineers, who by training are in an excellent position to advise properly.

Once a good system of illumination and planned colors has been put into operation, it is vitally important that an equally efficient plan of maintenance be inaugurated, in order to preserve and continue the benefits of modern illumination. If this is not done, the advantages of efficient lighting will gradually wane, but not the lighting costs. In just six months, dust and dirt can reduce the light output by half, yet it will cost just as much for electric current. For this reason, the expense of a good maintenance program will prove to be an investment, since the cost will be more than paid for by the light saved or by increased production and efficiency resulting from better lighting.

An efficient maintenance program should take into effect the conditions under which the lighting system operates. Naturally, the dustier the atmosphere the more frequently the lighting units will require cleaning. Under normally clean conditions, they should be dusted once a month. Every three months, the reflectors, glassware and lamps should be washed in a warm soapy solution containing a mild water softener, such as tri-sodium phosphate or borax. They should then be rinsed and dried. It is especially important to dry lamps and glassware thoroughly before replacing, to prevent cracking. It is likewise important to allow lamps and glassware to cool sufficiently before washing them, for the same reason.

This program should be augmented by the prompt replacement of burned out lamps. Lamps should be replaced as soon as practicable after they burn out, in order to maintain the efficiency of the system, which was designed to operate with all lamps burning.

Where fluorescent fixtures are employed, it is especially important to replace defective lamps or starters, unless no-blink type starters are used. If this is not done, damage to the ballast, lamp or starter may occur, depending upon which part is defective.

Incandescent lighting units are relatively simple in construction and operation and hence simple to maintain. Fluorescent fixtures, on the other hand, are more complicated in construction and operation, and consequently require more specialized

Fig. 3. In a dusty foundry totally-enclosed dust-tight luminaires should be used to minimize maintenance

knowledge. In order to maintain such lighting at a high level of efficiency, it is necessary that the maintenance organization be familiar with the theory and practice of fluorescent lamp operation. (See PLANT ENGINEERING, March, 1948).

When the electron emissive material on the electrodes of a fluorescent lamp has been used up there will no longer be a path for the current to follow from one end of the tube to the other. When this occurs the lamp will begin to blink. The blinking signifies the efforts of the starter to relight the lamp. Since the lamp cannot be relighted, the starter will continue its efforts until either the starter contacts fail or the ballast is damaged by the repeated high voltage surges. For this reason, it is important that a blinking lamp be replaced as soon as possible.

The life of the electron emissive material on the electrodes will be shortened in proportion to the frequency with which the lamp is turned on and off, since each time an arc is struck more material sputters off the electrodes than occurs while the lamp is in operation. Therefore, if the starter is sluggish or otherwise operates improperly, it may cause excessive starting efforts with consequent shortening of lamp life. Thus it is necessary to replace defective starters in order to protect the lamp and ballast from needless starting efforts. A no-blink type starter is available for certain sizes of fluorescent lamps and its use will prevent such trouble.

The cold cathode type of fluorescent lamp does not employ a starter, hence is not affected in this way. This type of lamp is equipped with a high voltage ballast that lights the lamp instantly without the necessity of preheating the electrodes.

The average life of most fluorescent lamps is 2500 hr. However, some may fail after a few hundred hours, while others may last 4000 or 5000 hr. Any unusual operation characterizing lamp or equipment defect should develop very early in the lamp's operating life.

Fluorescent lamps normally blacken on the ends as they near the end of their operating life. But, on the average, little blackening should occur during the first 500 hours of operation. Heavy end blackening early in lamp operating life indicates that the active material on the electrodes is being sputtered-off too rapidly and will result in short lamp life. This condition may be due to the circuit voltage not being within the ballast voltage rating, loose lampholder contacts, improper ballast, defective starter, or the lack of a starting compensator in the leading circuit of a two-lamp ballast.

If a lamp starts to blink it may indicate normal failure at the end of operating life. But if the lamp is comparatively new the trouble may be due to a defective starter, low voltage, improper ballast or low surrounding temperature.

Where the lamp fails to start promptly, look for a defective starter, or lamp not making proper contact in the lampholders.

When only the ends of the lamp remain lighted, the trouble may be due to a short-circuited starter condenser or welded starter contacts. In either case the starter should be replaced. If no-blink type starters are in use, the lamp ends will remain lighted in the case of a normally failed lamp. When the lamp is replaced, the starter will again function normally.

Of course, if the ballast has been replaced or other wiring work done on the fixture, there is a possibility that a mistake has been made in the wiring connections. In the case of two-lamp ballasts, lamp blinking may be caused by the individual starter leads from the two pairs of lampholders having been criss-crossed. Under such conditions the two lamps may start if both starter switches open at the same time, otherwise, if one lamp starts, the

other lamp may blink for some time or not start at all. This type of trouble is usually easy to locate, because after one lamp lights only one end of the other lamp will light before it attempts to start. Also, both lamps must be in the lampholders before one will start.

Where only the lamp ends remain lighted on a newly rewired fixture, it is possible that a mistake has been made in the wiring.

If a lamp makes no starting effort and no wiring errors can be found, it is remotely possible that the ballast is open-circuited and hence requires replacement. It is a good idea to check lamps and starters that appear defective in a fixture known to be in good order. A portable test board, equipped with lampholders and ballasts, is convenient for checking doubtful lamps and ballasts.

For safe lighting maintenance it is important to take certain precautions. A sturdy ladder or working platform is vitally necessary, and this should be equipped with means for holding lamps and fixture parts while relamping and cleaning.

Flexibility in Wiring Saves Time, Money

This building remodeling job necessitated the use of surface raceway wiring systems in order to accommodate the wants of prospective tenants . . . Rental areas totaling 40,000 sq ft made from old loft space

WHEN LOFT space in the Edwards Building, Cincinnati, was transformed recently into offices, the use of surface raceway wiring systems resulted in an approximately 30 per cent saving over the cost per floor for alternate in-the-wall wiring.

In addition to this economy, the renovated floors were ready for rental in seven months time, against an estimate of ten months required for floor modernization with concealed wiring.

According to engineers A. S. Rhine and O. S. Larkby, Jr., transformation of the structure into office space required major structural changes. Up to the present time, four floors have been modernized. Each has a rental area of 10,000 sq ft.

The modernization started on the ninth floor. Conventional erecting of walls and partitions was accomplished. Floors were installed and adequate concealed wiring was positioned for modern lighting fixtures, wall outlets and necessary switches.

When the floor was ready, prospective tenants came in to inspect the facilities. However, the tenants asked, when signing leases, that changes be made in the location of lighting fixtures. They asked that wall plugs be moved. New outlets and switches were requested.

In addition to breaking into the recently completed walls to modify the buried wiring, the building owners had a several thousand dollar investment for the initial wiring, the required changes and the labor.

When the next floor in this loft building came up for modernization, it was entirely refinished structurally. Carpenters, plasterers, sheet metal workers and plumbers completed their work and left the premises. No electric wiring was installed.

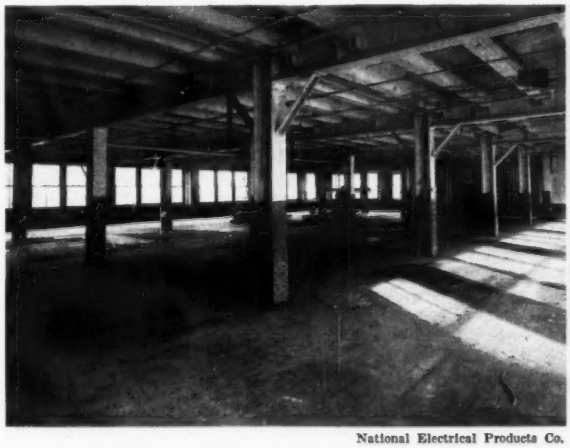
Prospective tenants were then brought in and asked where they desired lighting fixtures—where wall outlets should be installed—where and what switches would be needed.

Armed with this information, the contractor proceeded to wire the floor with raceways. The on-the-surface wiring was received with such enthusiasm that similar installations by now have been made on three other floors.

Main distribution circuits coming from a panel box off the main center hallway, run through this hall. These circuits were enclosed in the steel, two-piece surfaceduct raceway. The smaller metal molding was inter-connected to this main feeder and installed to bring wiring into the individual offices. It was also brought across the ceilings to service the fluorescent lighting fixtures. Other runs were mounted on office walls to serve duplex outlets and switch controls.

When the raceway installation was completed, the ducts were made scarcely noticeable by being painted to match color tones of walls and ceilings.

Surface wiring of a floor with the raceways represented a much smaller investment than was required per floor with a concealed wiring system. Since all circuits are in separate ducts, quick identification is obtained. The changes later requested by tenants—dictated by actual occupancy experience—have been quickly and economically made. The utilization of 2300 ft of 1⅝ in. by 2⅛ in. surfaceduct and 11,000 ft of two-piece metal molding $\frac{7}{16}$ in. by 1 in., has drastically reduced the normal, anticipated electrical maintenance of the wiring system in the building.



National Electrical Products Co.

National Electrical Products Co.

Fig. 1, Left. This photo shows the loft building as it appeared on a typical floor. Construction and window area was ample
Fig. 2, Right. One corner of a suite of offices when remodeling was completed

Plant Engineering As a Profession

By **RICHARD H. MORRIS**, Editor, Plant Engineering

A condensation of an article in the September issue of the Northwestern Engineer, the student publication of The Technological Institute of Northwestern University . . . Written upon request to supplement the Job Barometer* and aid students to gain a clear conception of the varied duties, advantages and responsibilities of the plant engineer

TO MANY individuals, who otherwise possess the proper combination of aptitude and abilities, a straight engineering career may appear monotonous and prosaic, the road ahead too long and rocky, or the scope for full range of imagination and ability too limited.

To this group plant engineering, as a profession, offers a great deal. It also demands a great deal. Probably no other branch of engineering offers the bitter-sweet contrasts, more opportunity for individualism, or enjoys such strong animosities and loyalties. There appears to be no middle ground probably because of the combination of technical, physical and temperamental qualities necessary for success.

Make no mistake, plant engineering is not a sinecure nor a haven for those who lack engineering aptitude. It demands natural engineering ability, a love of engineering, the type of man who could force himself to be a successful engineer in any field, a man of wide interests, well grounded in fundamentals, mentally alert but happier with diversified work than with routine engineering. He should be a combination engineer, businessman and executive, temperamentally stable, able to work well under pressure and to co-operate with others.

For this type of man, plant engineering offers: A wide diversification of work and interests demanding imagination and versatility; the satisfaction of accomplishment; opportunity to develop executive and administrative ability in what amounts to a business within a business and, close personal contact with all operating activities of an organization.

Functionally plant engineering is as old as industry itself, a combination of artisan activities which for generations have kept the wheels of industry turning smoothly. With the development of modern industrial organization and the rapid increase in the use of power for mass production following World War I, services and facilities increased in importance until they are now an integral and essential part of the production process.

During the transition period following World War I there was a trend toward grouping the artisan activities under one head. Technological developments and the growing complexity of modern industrial problems rapidly raised the requirements to professional level on a par with other departments.

Fundamentally plant engineering is a service function supplying: the physical framework upon which operating departments are hung; and, the network necessary for the organization to operate as a co-ordinated unit. While plant engineering as a function is now widely used and universally recognized in industry, many different titles are still used.

By and large plant engineering is not widely known among engineering students. The outlook, requirements and duties were covered concisely in the Job Barometer feature of the July 1948 issue of Pic Magazine. The essential features of this review were reprinted on page 15 of the August issue of PLANT ENGINEERING. This concise treatment, however, does not touch on such pertinent points as: The relation of plant engineering to industry as a whole; its relation to other engineering functions; its place in the organizational setup; the relative opportunities in large and small plants; and the effect of industrial concentration on possible job locations.

Industry in its broad economic sense is "human exertion employed for the creation of value." Elements essential to commercial success may be grouped in many ways but must always include such basic functions as: (1) **Management,** for the direction and co-ordination of effort; (2) **research and design,** for the basic details of the product; (3) **supply,** for the facilities and materials necessary for operation; (4) **production,** for the actual accomplishment; and (5) **sales** for merchandising and distribution of the product.

While the relative importance of these five functions will vary with each case, each element will be present in some degree in every business. This is true whether it be a one-man or a 30,000 employee concern; whether it be a construction, consulting or manufacturing company, a laundry, bakery or university. In every case someone must decide: what to do; how to do it; provide the facilities; take care of the actual operation; and, market the output.

Of these basic requirements, that of providing (or providing and maintaining) the facilities is always engineering. It is, in fact, plant engineering. In some cases, such as a college for instance, it may be the only engineering operation involved.

The relation of plant engineering to other branches of engineering in industry is best shown by reference to a typical manufacturing plant which will involve in some degree:

1. Research or Experimental Engineering concerned with finding better ways to do things. This may be further subdivided into two parts: First, basic research concerned with pure sicence and which may have or may not have an immediate commercial value; second, applied industrial research concerned with some commercial product, development or improvement.

2. Product Engineering concerned with the design of products of processes for production or commercial exploitation.

3. Industrial Engineering concerned with equipment and methods of commercial production. This is sometimes subdivided into: Manufacturing Engineering concerned with the planning and improvements of processes, methods and equipment; and, Industrial Engineering proper concerned with the analysis and standardization of labor, material and overhead.

4. Plant Engineering concerned with the planning, installation and maintenance of utility services, machines, tools, equipment, buildings and grounds, in fact, all physical aspects

Reprints of the Complete Article are Available

Due to the demand from students, colleges, industrial companies and engineers, this article has been reprinted in its entirety. The reprint incorporates the Job Barometer features, the U.S.E.S. job specification and Tom Hadley's poem "The Plant Engineer."

Copies are available without charge. Requests should be addressed to the Editorial Department, PLANT ENGINEERING, 53 West Jackson Blvd., Chicago 4, Illinois.

Comments from readers are invited on this or any other phase of plant engineering organization, responsibility, training or relation to other operations.

*See PLANT ENGINEERING, August, 1948.

of overall plant operation, except product design and production.

5. Management Engineering concerned with the application of engineering principles and analysis to the handling of men, materials, machines and money. Practically, this is primarily a consulting function of considerable importance in industry.

While the above classifications definitely place a plant engineer in the industrial setup, it does not outline too fully his duties. The Dictionary of Occupational Titles, used by the United States Employment Service, lists these duties broadly.

This job specification is not as complete nor as comprehensive as that shown under the "You Do" column in Pic Magazine, and is somewhat narrower in concept than general industrial practice today indicates.

Design, construction and maintenance of buildings and grounds is, of course, a matter of primary concern, not only from the standpoint of shelter but from the standpoint of production costs, industrial health, public relations and safety. Materials handling alone may range from 10 to over 50 per cent of production costs and in certain industries dominates the building design problem. Heating, ventilating, air conditioning and the control of smoke and fumes is of ever increasing importance. Parking lots, cafeterias, sanitary and convenience provisions for personnel, security and the guard force and fire protection are essential and increasing in importance as the necessity for industrial relations is more fully recognized.

Because of the large amount of power used in modern industry, utility design, installation and operation is of prime importance. This includes electric light and power, steam, compressed air, water and sewer service. These often involve contact with outside concerns and very frequently with municipalities.

Repair service must be provided and machinery planned, installed, repaired and lubricated. Instruments and controls must be provided. Traffic inside and outside the plant planned for.

To minimize production delays, preventive maintenance programs must be initiated and an adequate stock of repair parts ordered and stored ready for use. Elevators must be operated and housekeeping carefully watched.

The plant engineer thus has responsibility for the multitude of details necessary to keep the plant operating efficiently. He operates "a business within a business" and his work covers every department and every activity so he must have a working knowledge of all processes. Much of his work is covered by various state and municipal codes and he deals in insurance and labor relations so he must know some law and be a diplomat. He must be a good manager and keep costs down so he must know something of economics, cost accounting, and sound industrial organization.

Organizationwise the plant engineer fits into the large industrial unit as a staff member of the general manager on a par with the controller, sales manager, etc. In a single plant unit he will fit into the plant manager's organization as a department head on par with the production superintendent, quality control manager, industrial engineer, or purchasing agent.

Many individuals have an aversion to large organizations. Numerically, however, large operating units are comparatively few. In the 21 groups classified as manufacturing industries, the Social Security Board lists 216,610 reporting units. Only 22,416 units employ over 100, however, and of these but 2207 have over 1000 employees.

Thus the number of large units is extremely limited, for even 1000 employees is not what might be considered an unduly large plant.

Many individuals have decided geographical likes and dislikes. This is a factor which must be considered when choosing a career approximately 60 per cent of American industry is concentrated in the triangle formed roughly by Chicago, Baltimore and Boston. While industry, especially small industry, is well scattered over the 48 states, those who insist on certain locations will have less choice.

Industrial plants, however, are not the only field for the plant engineer. Many service industries such as hospitals, hotels, office buildings, laundries, bakeries, warehouses, colleges, universities and other institutions offer a field of endeavor nearly as large.

Finally, while the basic elements of engineering may be learned in colleges, plant engineers are made on the job. There is no substitute for varied practical experience, a certain degree of manual skill and some knowledge of the artisan trades. Little of a plant engineer's work is routine—much of it depends upon the "feel" of materials and forces. This "feel" or "instinct" comes through doing things, it helps avoid blunders when faced with new conditions; helps the boss sense what his men are doing; and builds their confidence in him.

"I know dear, but the Elite Electric Bath charges you three dollars for the same thing and after all —."

New Methods of Storage Tank Support

By **FRITZ KRAMRISCH**, Structural Engineer,
Albert Kahn Associated Architects & Engineers, Inc., Detroit

Past practice has always called for a continuous foundation slab for underground tanks, closely-spaced cradles above ground . . . Author has re-designed tank farm layout for General Motors utilizing lugs for supports . . . Lugs are fastened to smaller footings with the result that the entire job is far more economical

HORIZONTAL tanks for storage of oil, gasoline, kerosene, and other liquids used for different industrial purposes are provided near every plant. They are generally arranged in groups (fields or farms), above or below ground according to the Underwriters' requirements.

Relatively close-spaced cradles or slings are generally used to support such tanks if they are above grade. For tanks below grade the most common design consists of a continuous foundation slab to which the tanks are anchored as protection against uplift. The backfill has to be tamped thoroughly to provide lateral support and prevent excessive deformation. This is an expensive operation if properly handled as the space between the tanks is small. Several inches of concrete are often poured between the tanks and tucked underneath to produce a continuous cradle support.

Either one of these methods including all related varieties give workable solutions but neither of them represents a correct or economical solution.

Analysis has shown that shear stresses acting tangentially to the circle transmit the load from the tank onto the supports. Thus the tank tends to move, if free action is permitted, mainly in a longitudinal direction. A tube supported like that suffers only slight deformation. Under a "completely-filled" condition the main diameters of the tube remain unchanged.

Any intermediate supports not surrounding the entire pipe stiffly, like cradles or slings which are applied only to a part of the bottom of the tank, introduce additional circumferential bending stresses.

At the tips of the supports a high concentration of load is taking place, which has to be taken entirely by the thin tankwall. This is especially true where the contact between the support and the tank bottom extends only over a part of the bottom semi-circle.

Cradle supports should not be placed far apart, because the reactions become too big, but if the supports are placed close together, load distribution in the tank section produces the effect of a continuous support and all action in a longitudinal direction is eliminated. Thus, any shell action is prevented, and the tank is forced to act as an arch which represents a very unfortunate structural condition for the tank due to its thin wall.

The only way to prevent the circumferential bending moments in a tank is to make it possible for it to act as a shell by providing discs or stiff ringgirders at the ends of the tank, if intermediate supports are required.

This method of support has been used up to now only for thin walled pipes in such major projects as large pipe lines and pipe bridges or for gas tanks with internal pressure and greater wall thicknesses.

For storage tanks for industrial purposes the customary use of cradle supports in concrete or steel is still adhered to. These are spaced according to the intensity of the fear complex in the designers mind and not according to any justified calculation.

There exists probably two main reasons for it. The first reason may be attributed to the incorrect concept that a tank, due to its external appearance, may be treated like a solid wooden log. The second reason seems to be the costs of the ring supports. Since supporting tanks by cradles is common practice, the designer sees no reason to replace it by a more expensive design, simply to improve stress conditions in the tank, except for special or major constructions.

Every designer, however, would gladly accept a new concept, if it offers at the same time an advantage in lowered costs.

For horizontal storage tanks of not excessive length the additional costs of the stiff ring-supports can be eliminated entirely by using the endwalls (tankheads) for this purpose. Such an arrangement will not only improve the design but reduce the total costs of the structure.

To the writer it seems practical to support the tank by lugs welded to the tank walls as close as possible to the tank heads. The best location for such a support is at the ends of the horizontal diameter of the tank where the shear is a maximum. This is shown in Fig. 1. In this case the purpose of the tankheads is a dual one. They stiffen the tubular section to permit shell action, and take all circumferential moments produced by the shear at the support.

Such an arrangement incorporates all the advantages of the tubular beam with only small costs of the lugs and their welding added to the total cost. At the same time it would make any bands or anchor straps unnecessary.

Every tank is supported by two pairs of lugs placed at its ends very close to the tankheads.

The tank is, of course, presumed to be strong enough to carry its dead weight, fill and surcharge, (earth, if underground) safely over this span which is only a little shorter than the length of the tank.

Each lug, Fig. 2, consists of two vertical stiffening plates welded directly to the tank wall, and a horizontal bearing plate welded to the bottom of the stiffeners, and also to the tank wall. The bearing plate has to be slab supported by the two stiffeners for gravitational load and

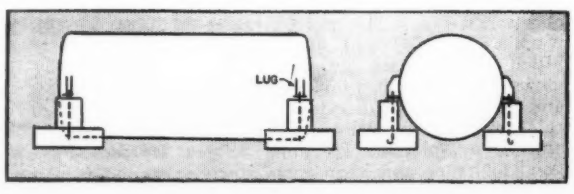


Fig. 1. This sketch shows correct placement of lugs and footings in relation to tank. Anchor bolts protect against uplift of the entire assembly

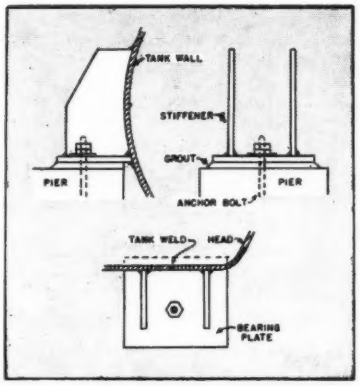


Fig. 2. This drawing shows the details of the lug and bearing plate assembly

for uplift in case of tanks under ground. The anchorbolt has to transmit the eventual uplift safely into the foundation.

To obtain common action and a better stiffening effect of the tankhead, each lug is placed astride the welding seam which connects the tank head with the straight tank wall. This way the interior stiffener is welded directly to the tank-wall, and the exterior directly to the tank head.

I had the opportunity to apply this method of tank support in the redesign of two tank groups, which were previously designed according to the customary practice. In both cases the tanks were below grade.

In one case, Fig. 3, the farm consisted of nine horizontal 12,000 gal tanks for the storage of oil, gasoline, and kerosene for the Engine building of the General Motors Corp., in Pontiac, Michigan. The tanks are of 10 ft-0 in. diameter, 22 ft-0 in. long out-to-out, and of $\frac{5}{16}$ in. wall thickness, with the center of the tanks 9 ft-0 in. below grade. The tanks have shallow dished heads of $\frac{3}{8}$ in. thickness and 300 in. radius.

TANKS ABOVE GROUND

1. Savings

a. Omission of intermediate supports, (Cradles and footings).
b. End supports consist of straight piers instead of cradles, which are expensive in formwork and reinforcement. The piers are easier to level off to an exact elevation and a smooth top than are the curved cradle seats.
c. Omission of anchor straps.
d. Easy erection.
e. Installation and maintenance (painting) are much improved because tank bottom is made more accessible.

2. Extra Costs

a. Material and labor for lugs including welding to the tank.

TANKS BELOW GROUND

1. Savings

a. Continuous foundation slab is replaced by single footings with piers at ends of tanks. The piers are levelled off by grout to exact elevation and smooth top.
b. Reduced excavation because single footings can be raised between the tanks.
c. Omission of concrete fill for continuous cradle.
d. Omission of anchor straps.
e. Easy erection.
f. Installation of piping can start right after tanks are set, not hampered by pouring of concrete fill.
g. Increased durability because free tank bottom permits inspection and repair of protective coating after tank is set.
h. Backfill does not need special tamping because no lateral support for tank is required.

2. Extra Costs

a. Material and labor for lugs including welding to the tank.

The farm is subdivided into three groups. Three tanks are under a trucking pavement, three tanks under a pump house, and the rest under free grade. Originally one continuous slab provided the support for all tanks. The pavement and the pumphouse were supported by independent columns, carried down to the same foundation slab. This design was changed as follows: The columns for the support of the super-structure were moved close to the tank supports.

Their common piers were placed on single footings. Each tank was carried by 4 lugs, 20 ft-0 in. center to center, welded to the tanks, set on levelled ground, and anchored to pier and footing. Figure 3 shows schematical longitudinal and cross sections through the structure as well as the details of location of the lugs used throughout for all nine tanks.

The other case concerned a smaller tank field six 200 gal horizontal oil storage tanks for the Dynamometer Building of General Motors. The center of the tanks is 7 ft-6 in. below ground. A conti-

(Continued on page 57)

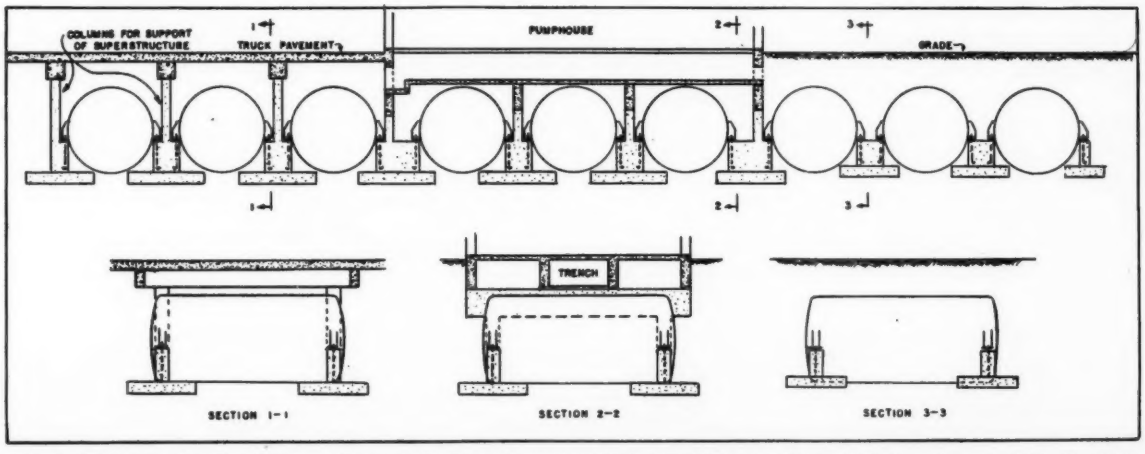


Fig. 3. Here are the details of a job recently finished at the Engine Building of General Motors Corp. in Detroit. Note that the piers which support the tanks are also common to the overhead structure of truck pavement and pump house. Details of the job are shown at the right in the drawing

Sand Protects Metal from Sand

Contributed by
H. B. McDermid

IN ONE OF the larger mechanized foundries of the country, it was often observed that chutes handling dry sand wore out rapidly, particularly on the bottom sheets.

As each one of the three foundries handled many hundreds of tons of dry sand daily through its re-conditioning system, wear was to be expected. But as the castings produced were badly needed it was up to the engineers in charge to see that as much wear as possible was eliminated, and that the necessary repairs were completed with minimum "outage" time.

One particularly vulnerable spot was a hopper chute over which flowed all the sand in the system of one foundry. Holes were worn in its ¼ in. steel bottom plate every three weeks. The usual practice had been for the maintenance crews to weld a patch over the hole on the outside while the chute carried its regular load, thus producing no outage time at all, and in three weeks or so weld another patch upon the first one, when the inevitable hole wore through. Some times the plate would be on the job with four patches piled one on top of another, and still doing business in the original way.

Obviously, this could not be kept up, so the field engineer had to eliminate some of this wear and consequent final delay. After considerable study, he came up with a method that was cheap and highly effective. Checking the slant of the bottom plate and the angle of repose of the sand, he laid out a new bottom plate that could be bolted on the chute when being replaced. On its top surface he had welded on edge, several baffle plates ¼ in. by 1½ in. and long enough to cover the available net width of the plate. (See Fig. 1)

These plates were placed at right angles to the sand flow and at such a distance apart that the sand dammed up by one, would nicely cover the top of the bottom plate up to the next baffle plate when the plate was installed in working position. Thus the first gush of sand after installation, filled the hollows behind the baffle plates and effectively covered the entire bottom plate, so any sand following after could not touch the steel plate at all, but ran on top of the bed of inert sand. The only place exposed to wear was the top edges of the baffle plates and that wear was inconsequential. So, from being a constant, ever-recurring source of trouble,

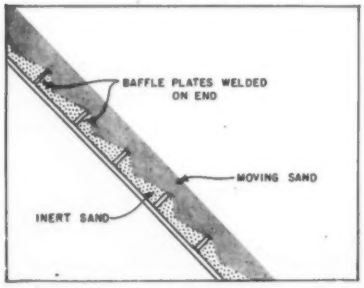


Fig. 1. The baffle plates welded on end created pockets of inert sand which protected the bottom plate from wear

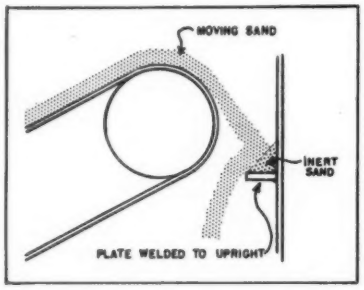


Fig. 2. The horizontal plate welded to the upright allowed a pocket of sand to form and thus protected the upright from the constant abrasive action of moving sand

this funnel became one of the show spots of the system, and carried full load for fourteen months without a second's trouble.

As the position of the baffle plates insured that the steel plate must be fully covered with stationary sand at all time, it is reasonable to expect that the plate would last indefinitely.

Detailed study of the friction points in the system will bring to light quite a number of vulnerable points, to which the same idea, differing only in the details of its application, can be used for preventing serious wear. One example was that of a vertical plate the function of which was to guide the sand discharged from the end of a belt conveyor. (See Fig. 2) Here the sand wore constantly against a comparatively small spot and the plate soon gave up, necessitating a new plate or a patch after a short period. The remedy was to attach a shelf to the sheet absorbing the punishment at such a point that oncoming stream of sand struck into the pile of sand held there, so that its wear was, as in the case of the plate described above, absorbed by a covering of inert sand instead of the bare steel plate. It is necessary that positioning be carefully done by the mechanic.

Sometimes a bad spot is found where it is impossible to force sand to lodge for a protective covering, then sometimes a heavy rubber lining will be found the best bet available. One case occurred in a place where conditions necessitated that a rectangular chute turn a 90 deg. bend horizontally while dropping

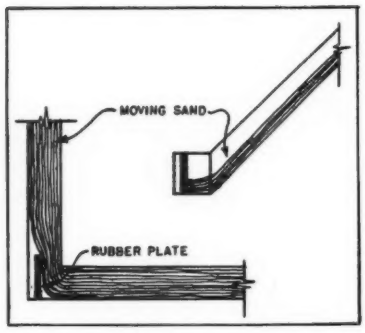


Fig. 3. In this instance a rubber plate protected the sand chute from wear at the corner of the 90 deg turn

down a 45 deg. slope in the vertical plane. That made a severe check in the sand stream where its direction was forced to change, and no kind of steel could take the grief for long. A short heavy rubber plate was installed parallel to the vertical side of the chute to take the impact of the sand stream. This lasted for a surprisingly long time and was found to do even better when hung loosely from the top edge so that it could swing away and give somewhat under the impact of the heavier surges, and so not be forced to control the sand stream by rigidly forcing it to deflect instantly. Figure 3 shows the details.

Lighting Practice At Ashtabula

MAINTENANCE of illumination on a high, intense level is achieved at Reliance Electric's Ashtabula plant with the use of artificial lighting. While daylight is available throughout the sash area, dependence is placed on a combined system of mercury vapor, incandescent and fluorescent lighting to meet standards of illumination prescribed for this plant of 125,000 sq ft.

Low bays are served continuous runs of 3/40-w standard industrial type fluorescent fixtures, which are mounted on 16-ft centers installed 15 ft above the floor. Illumination in high bays is provided by twin 400-w mercury and 500-w incandescent medium spread porcelain enamel units, which are mounted 24 ft high with 17-ft by 20-ft spacing. For office lighting, continuous runs of 2/40-w fluorescent units mounted on 8-ft centers are utilized, providing an output of 50 footcandles.

Factory lighting levels range from 35 footcandles in storage areas to as much as 100 footcandles in inspection areas. By changing the spacings between lighting fixtures, levels of from 50 to 75 footcandles are maintained in certain departments where work of precision

character demands exceptionally high visibility. Lighting equipment throughout the buildings has been installed above the truss line to assure uninterrupted use of the space between the floor and trusses.

All fixtures used in this lighting installation were chosen with the factor of maintenance depreciation as the uppermost consideration. Accordingly, they allow a 33⅓ per cent decrease in efficiency over a period of six months as a result of normal lamp output loss and grime accumulation. Fixtures are readily accessible for cleaning periodically, replacement of lamps or tubes, or the performance of other maintenance work as required.

Auxiliaries for 400-w mercury and fluorescent equipment are the high power factor tu-lamp type, while fluorescent starters are of the manual reset, no-blank type.

Adjustable Scaffold Can Be Made From Scrap Materials

Contributed by Philip J. Smith

THE CONVENTIONAL scaffold for maintenance work never seems to be the correct height. Short men must strain to reach their objectives, while taller men have to bend their backs into an uncomfortable position to do their work. In order for a welder or other maintenance man to work for any length of time, he must be in a comfortable position.

In shipyards and other locations, overhead welding is done while the welder stands on a scaffold of some description. Buckets or wooden sawhorses are the types most frequently employed. Each of these, however, is dangerous and inadequate; they will overturn easily, and cannot be lowered or heightened.

An adjustable scaffold such as the one described here, has many advantages. With this improved type of scaffold, one can easily adjust the height to his specific requirements and, at the same time, have a sturdy foundation upon which to work. When doing work on a location where a scaffold must be built with one end higher than the other the following type of scaffold will be of great value.

Taken from a paper presented in a recent competition sponsored by the James F. Lincoln Arc Welding Foundation.

Scrap pipe and plate trimmings that have been discarded may serve as the material to construct the adjustable scaffold. However, it is important that the inside pipe fit snugly to prevent sway. The welds that hold the braces should be at least ¼ in. welded all around. This will prevent a leverage action. The bottom plates may be made from any solid scrap plate, at least ⅜ in. thick.

Construction Simple

The construction of the adjustable scaffold is simple. See Fig. 1. Use a 2 in. pipe, 36 in. in length. Starting at the top, bore ten holes 3 in. apart. The inside pipe should be 1¾ in. cut 36 in. long. The extra space provided at the bottom of this pipe will act as a wedge. Bore one hole parallel with the bottom hole in the outside pipe. The bolt when inserted, will extend through both pipes and will serve as a rest for the inside pipe.

The bottom plate is constructed of flat sheet metal. This should be at least 1 ft square. The braces from the bottom plate to the upright pipe should be solid, 6 in. high, and cut on a 45 deg angle. This will provide ample strength but will not interfere with the holes.

The cross braces will be welded ¼ in. continuously. They are 30 in. in length. (Scrap pipe or angle iron may be used.) This distance will provide space for two 12 in. boards, as this is the width most commonly used for staging. The supporting cross angles also can be made from scrap. These are cut 46 in. in length, and welded continuously.

Low Cost

An adjustable scaffold can be assembled by this procedure at little or no cost for materials, for all parts can be gathered from scrap piles or made from surplus material. The stand is welded for durability; yet, it may be taken apart easily, so as to transport it to different jobs. The advantages of this scaffold are numerous. It will require little initial expense, no upkeep, and it will far outlast the wooden scaffold.

One end of an adjustable scaffold can be lowered or raised, maintaining a level platform. See Fig. 2. In extreme angles the resting plates may be tacked to the deck. This will insure the stability of the stand. A temporary leg may be tacked, or wedges can be used to keep the back side level. It can be changed easily from one position to another, and the worker can accomplish his job faster and with a neater finish.

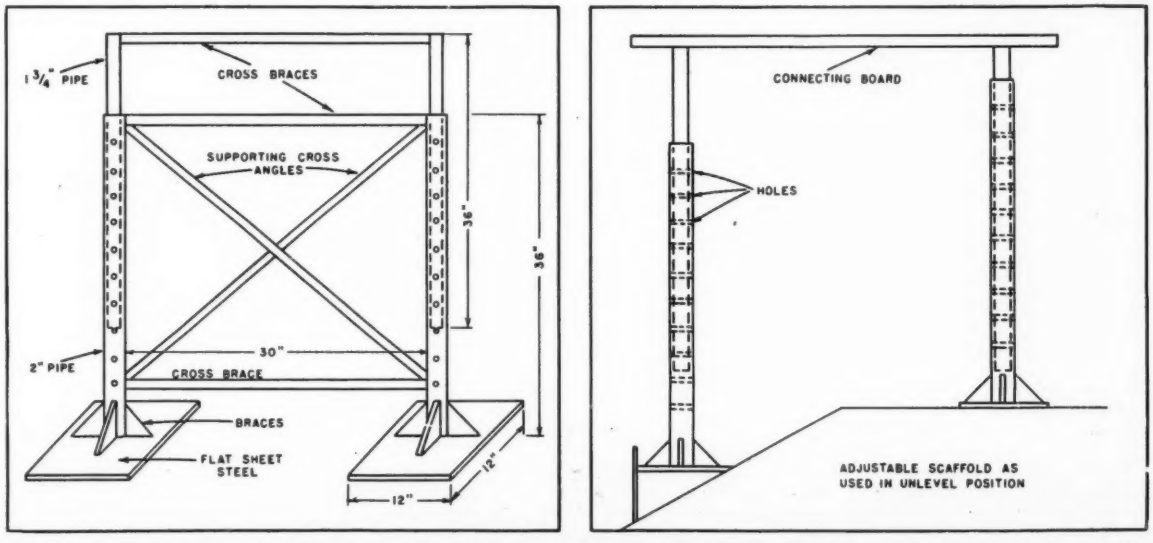


Fig. 1. Left: Construction details of the adjustable scaffold. Fig. 2. Right: This drawing shows the advantages of the adjustable scaffold in locations where various levels are encountered

Industry Puts Cleaner on a Spot

CLEANING SHEET aluminum had become a major problem at a metal stamping plant. The problem was made more acute because the plant was trying to keep its production rate close to a heavy demand for their finished products. The sheets arrived from the aluminum mill coated with a tacky, corrosion resistant film. Delay in getting the sheets into production was due to the time required to clean them in the alkali type water solutions which their equipment was designed to use.

A quick easy cleaning method resulted when a Standard Oil engineer persuaded the plant to try Brymul A. Approximately 2 per cent of this chemical was added to the alkali cleaning solution. The aluminum sheets were washed in the mixture while it was being agitated. Since Brymul A is an emulsified solvent, it considerably improved the cleaning action of the alkali solution.

Industrial experience with products of the Brymul A type has disclosed an added advantage when this type cleaner is used properly. When a petroleum solvent containing the proper emulsifier is applied to a surface, the solvent tends to penetrate the surface in its normal manner. However, if water is applied after the solvent, the combination behaves much like a wetting or surface active agent. Penetration is markedly increased and the solvent action enhanced.

Water and Brymul A should not be applied at the same time to the material to be cleaned, unless conditions are similar to those outlined earlier. Brymul A should first be sprayed, dipped, swabbed or otherwise applied to the soiled surfaces. After an interval, to permit the normal solvent action to occur, hot or cold water should be applied. Some users have found the presence of an alkali in the water to be unnecessary while others have found it advantageous. By applying the water after the solvent has penetrated the soil, full advantage is taken of the penetrating power of the solvent itself and full opportunity is given for the wetting power of the solvent and water to loosen the soil.

An unusual use of Brymul A as a textile spot remover is illustrated by the experience of a large silk weaver. This concern stored a large amount of gray goods for some time before it was shipped to a dye house. The first pieces dyed showed spots which definitely resisted the dyestuff. The weaver was notified that his goods were defective. An Esso Standard Oil engineer investigated this trouble and with the weaver's plant personnel discovered that the spots were apparently oil spots which had become permanent during storage, possibly through oxidation. In an effort to salvage the goods, the engineer determined that Brymul A if properly applied, would remove the bulk of the spots. Brymul A was applied by brush to the spotted areas as the cloth passed over an inspection frame. Each spot was completely saturated and, after permitting penetration for approximately 48 hours, the cloth was washed in the usual way, followed by piece dyeing. Practically all the material was salvaged as salable.

This cleaner is also used by repair men to clean oil burner parts. They discovered that the parts could be quickly and easily cleaned by dipping them in Brymul A and then swishing them out in water. Not only are the parts cleaned well, but the men avoid skin irritations that resulted when some other cleaners were used.

A radio crystal maker employs this solvent to remove lapping compound from crystals. Agitation has not been found necessary and the crystals are satisfactorily cleaned after being allowed to dry in air.

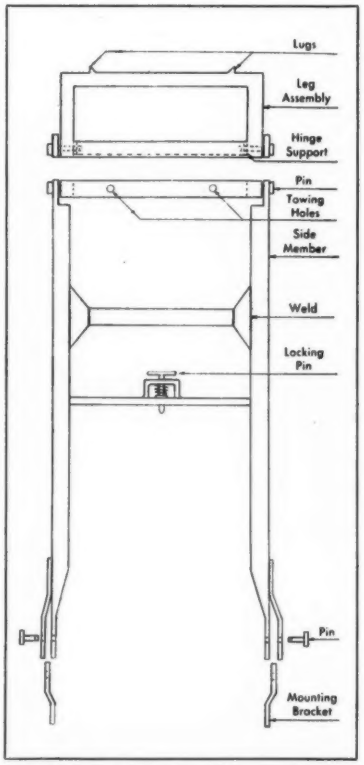
A blasting cap concern received complaints from workers because they could not wash up quickly before leaving for home. The worker's hands accumulate a tarry substance which ordinary soaps or detergents will not remove effectively. Dissatisfaction ceased when Brymul A was supplied to them. The men dipped their hands in it, it is allowed to penetrate the tarry substance for a few seconds, and a quick wash in water will remove the tar and Brymul A.

This cleaner has also been used to remove oil and grease spots from industrial flooring. Following conversion to civilian activity many plants relocated much of their machinery. This made visible soiled areas caused by drippage of oil from the machinery. Not only are such soiled floors unsightly but actually dangerous from a personnel standpoint. Usually the location is thoroughly saturated once or twice with Brymul A. After it has had an opportunity to penetrate, the Brymul A and the oil are removed with the conventional plant scrubbing equipment using an alkali cleaner. *From the August issue of Oilways, a publication of Esso Standard Oil Company, New York.*

Attachment Broadens Use of Truck

AN IMPROVISED rack attached to an electric pallet-type hand truck now in use at Auburn Works permits the handling of pallets, skids and carts with one truck. The front of the rack is attached to the sides of the fork frame and the rear is supported by a folding leg assembly. The leg support is a rectangular frame, hinged from the sides of the rack.

Attaching the rack in this manner permits it to be folded up out of the way so that the full length of the forks is usable. Upon lowering the rack the truck is converted into a platform model for handling skids. Two holes in the top cross member of the leg support permit the use of crossed towing hooks to tow carts in trains through narrow aisles without difficulty. Two lugs welded to the lower cross member are spaced so that they fit between the forks and relieve the side strain on the rack when towing carts around corners or when pushing them. The dimensions in the accompanying sketch have been omitted because the size of the skids to be handled would determine the size of the rack. The construction of the rack may be modified so they can be attached to any make of truck. *By P. E. Hickey, Materials Handling Engineer, International Harvester Co. Auburn Works, Auburn, N. Y. In Storage Battery Power, a publication of Edison Storage Battery Div. Thomas A. Edison, Inc., West Orange, N. J.*



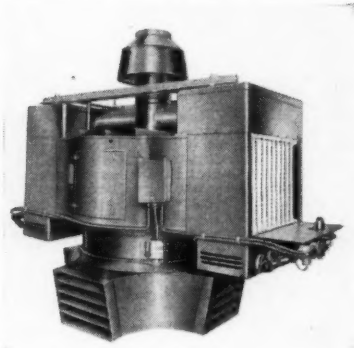
This detailed drawing of the rack shows the various components and method of attaching to the truck

New Products and Methods

(Continued from page 20)

Unit Heater

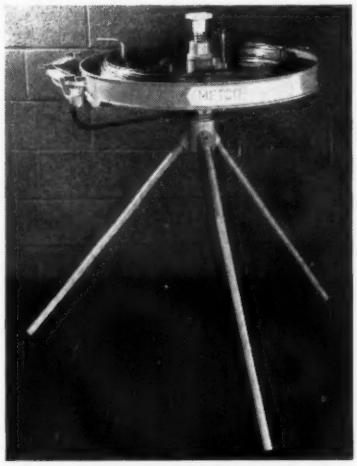
12 A new, self-contained gas-fired revolving unit heater, using either natural or manufactured gas has been announced. The heater combines gas burners, heat exchanger and combustion chamber with a motor-driven fan and revolving discharge outlets. Designed for overhead location, it projects the heated air to the working level and by means of the revolving outlets circulates the warmth in all directions, under obstacles, into pits, and reaches into the furthermost corners. Even in the summer



these heaters are at work, but here they become a cooling device by simply turning off the gas and turning the fans on. The air is circulated in the same manner as the heated air in the winter. The unit heater is described as a ruggedly constructed piece of equipment. L. J. Wing Mfg. Co.

Wire Straightener

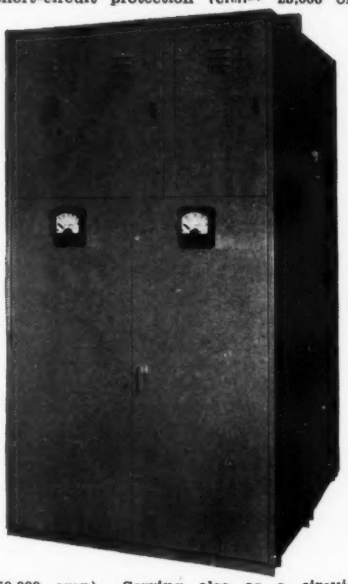
13 A new Wire Control and Straightener Unit has been announced. The Metco Type 2W—Wire Control and Straightener Unit is described as superior in appearance, efficiency, construction and convenience. New and outstanding features include; 1. All metal



construction to give stability and rugged, continuous trouble-free operation. 2. Outer metal hoop keeps the coil on the reel and prevents the wire from "riding off", or getting tangled under the arms. Adjustable to accommodate any size coil. Handles 3/16 in. wire easily and efficiently. 3. Ball type thrust bearing makes it free-running and eliminates all unnecessary drag from reel top. 4. All adjustable parts equipped with thumb screws for quick and easy adjustment. Easy-to-reach brake to adjust reel top tension. 5. Easily assembled in 10 minutes. 6. Easily adapted to mounting on automatic set-ups, bench or other desired place. 7. The straightener unit is efficient and adjustable. Metallizing Engrg. Co., Inc.

Controllers

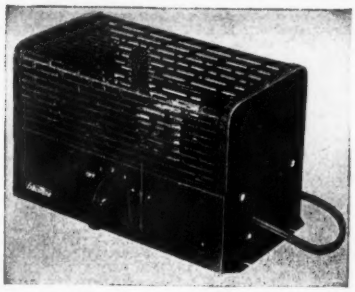
14 A new line of low-voltage controllers for use with a-c motors up to 800 hp (at 550 v.) and for d-c motors up to 350 hp (at 230 v.) has been announced. These new metal-enclosed controllers are designed for controlling squirrel-cage, wound-rotor synchronous, or multi-speed a-c motors, or d-c motors. Common applications for which they are desirable are pumps, mixers, grinders, mills, and similar drives in the heavy industries. The new controllers are unusual in that they include in one unit not only the conventional equipment required to start, stop, and control such motors, but in addition include a completely integrated draw-out air circuit breaker which provides adequate short-circuit protection (either 25,000 or



50,000 amp). Serving also as a circuit isolating device, this draw-out air circuit breaker is designed so that it is readily interchangeable. Therefore, when one is removed for servicing another may be substituted immediately, thus preventing lengthy delays. In addition, when the breaker is pulled out to the inspection and test position, it is mechanically latched and disconnected from all power. General Electric Co.

Intercom Amplifier

15 To increase the power volume needed for adequate coverage of large or noisy areas, there is announced a new inexpensive booster amplifier for use with company's intercom and sound systems. This new compact Model P-29 Booster Amplifier provides increased paging volume on systems designed to call or page all stations simultaneously. When used with an existing sound or intercom system, audibility of staff stations and reproducers located in large and noisy departments is substantially increased. When coupled with a standard reply station, this booster solves for the first time the problem of providing audible two-way intercommunication in very noisy locations,



such as machine shops, press rooms, factory areas, etc. Operating on 110-120 v, a c or d c current, the Model P-29 Amplifier

(Continued on page 50)

Don't Drill— Just Fire!

16 Fastening pipe hangars to concrete or metal always has been a tedious job. It generally means star drilling, inserting toggle or anchor bolts and other time-consuming efforts. One recently developed remedy for this problem is a powder-actuated driver that will "pin" a pipe hangar to a concrete ceiling or wall, steel I-beam or column, in a few seconds. It also fastens wood to concrete or steel.

The small, portable tool embeds studs in steel or masonry by the discharge of a blank cartridge. Once embedded, the studs have tremendous holding power—up to several thousands of pounds. Two diameters of studs—⅜-in. and ¼-in.—may be used by interchanging the barrels of the tool. There are several varieties of studs available—externally or internally threaded or plain, headed types. Operation of the 5-lb tool is simple. The stud, with the cartridge attached to it, is inserted in the barrel. The operator then rotates a spring-loaded safety arm 180 deg to move the firing pin into position for contacting the cartridge primer. Holding the barrel against the material to be penetrated, the tool is pushed forward sharply to discharge the stud.

Every conceivable precaution is said to be "built in" the tool to minimize hazards. Possibility of accidental discharge is negligible because the firing pin cannot reach the cartridge primer until the safety arm is rotated. If the tool is dropped accidentaly, the safety arm instantly moves the firing pin out of position. It is virtually impossible for the stud to ricochet because the stud remains fastened to the cartridge with a piston-like attachment until the instant of penetration. Moreover, there is little space between the barrel opening and the stud. There is no recoil or flash. The tool can be operated with one hand. Besides its advantages in fastening pipe hangars to concrete or metal, the tool also is used by carpenters, electricians and other craftsmen for many different chores. Switch and junction boxes can be anchored to concrete or metal in a few seconds, wood joists or nailing strips can be "studded" to concrete ceilings, and metal window frames can be shot into place. Mine Safety Appliances Co.

New Products and Methods

yields an output of 8 watts and consumes a maximum of 53 watts of electric current. Housed in a brown crackle finished metal cabinet of sturdy construction, it is 5¼ in. high, 4½ in. deep and 8⅞ in. long. A combination four-step volume control and on-off switch regulates volume to the desired level. Executone, Inc.

Plastic Case Battery

17 A storage battery, made with a plastic case and said to offer more starting power with less space and weight. Features transparent polystyrene plastic as the container material for the battery. The battery is rated at 24 v, and is capable of producing 15 hp for 3 min. The container permits a ratio of

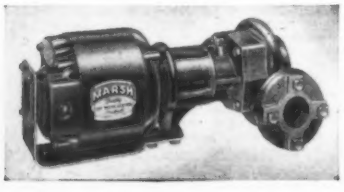
power to cubic content and weight greater than heretofore possible. It has connections for venting gas automatically on charge and discharge, a no-overflow device to prevent over-filling, and complete filling and operating instructions which are molded into the plastic. Electric Storage Battery Co.

Lamp Changer

18 Announced is an improved type of pole now available with adaptable lamp changers. This new lightweight steel pole is furnished in 5½ ft interchangeable sections and is so designed that sections may be quickly joined together to provide a pole of the necessary length for easy replacement or removal of light bulbs up to a recommended limit of 30 ft. Sections are securely locked together by a spring actuated button which also permits quick disassembly. Each section is insulated for positive protection against shock from exposure or contact of changing pole or head to live wires. McGill Mfg. Co., Inc.

Circulating Pump

19 A new two-position circulating pump that can be mounted in either the horizontal or vertical position has been announced. The new pump makes mounting changes simple, and requires the manipulation of only four bolts in changing the pump to desired position. Other features of the pump include a special rubber coupling with brass inserts that is secured to the motor shaft and pump shaft to eliminate transmission of vibration. The pump shaft itself is assured positive lubrication by the oilite bearing in which it rotates. This bearing is fed through an oil cup in the housing and is kept water-tight by a carbon seal and a neoprene rubber seal around the pump shaft. Power is supplied by a Jack & Heintz continuous-duty 1/6 hp motor. This is a single phase, 60 cycle, 110 v unit supported by rubber shock absorber mounts and secured to a steel support to maintain proper alignment. The two-position pump is available with either 1¼ or 1½ in. pipe. Marsh Heating Equipment Div., Jas. P. Marsh Corp.

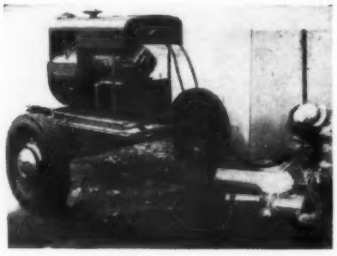


Floor Drying

20 Industrial Floor-Dry has a wide application as a drying agent on floors. It is relatively hard, granular material, possessing remarkably high absorptive properties for oil, grease and water drippings, which so frequently present a hazardous and costly production problem. This is particularly true in those thousands of industrial plants where the operations require the use of cutting oils and coolants which inevitably find their way to the floor. Sold in 50 lb bags. Eagle-Picher Co.

Light Weight Welder

21 A new light-weight, engine-driven, dc welder, designed for a wide range of general applications, has been announced. Weighing only 660 lb for a maximum of 250 amp of welding current, the new welder can be easily transported on a pick-up truck, leaving ample truck capacity for other equipment. It is powered by a Wisconsin VF-4 air-cooled engine, speed-ratio-coupled by a steel-core V-belt drive to a Type WD-3200 generator with 50 per cent duty cycle. A fully calibrated dual control permits the accurate setting of a desired welding current before the arc is struck. The welder has a built-in auxiliary power outlet of 110 volts for the operation of lights and



power tools, and stands on a full-length, rigid, welded steel base. The over-all length is 44⅛ in., and it is 24½ in. wide and 35⅜ in. high. For greater portability, it can be furnished mounted on a two-wheeled, pneumatic-tired trailer with a standard 62 in. track. Welding Equipment Div., General Electric.

Vacuum Cleaner

22 Built in four sizes, these heavy duty vacuum cleaners, powered by 2, 3, 5 and 7½ hp motors, and explosion proof if desired, have static water lifts ranging from 60 in. to 105 in. with air velocities from 315 mph to 480 mph moving from 200 to 360 cfm of air. These compact units are completely portable and are easily moved anywhere on three smoothly rolling 8 in. ball bearing casters. The low center of gravity prevents any possibility of tipping and the compact design enables them to be moved readily through aisle ways and congested areas. An exclusive, self-cleaning air filter of approximately 1,000 sq in. keeps the machine at high efficiency at all times. This self-cleaning filter is located in the vacuum head and may be operated by the vacuum-blowing lever even when it is running to save cleaning time and eliminate dust and health hazards. A patented principle allows the unit to be changed instantly from suction to blowing by the movement of this lever. This is important as there is always immediately available a powerful blast of clean, dry, air for blowing out motors, gears, belts, fans and intricate machinery. This combination blowing and suction feature can be used to special advantage in removing oil-soaked lint and grease around such equipment as textile and knitting machinery, paper making machinery, and in similar places where dirt, dust and grease can spoil material in process. Another outstanding feature is the ability to pick up wet or dry substances without harm to the filter or tank, and without any special attachments or equipment. All sizes are equipped with two intakes and one or both can be used with either 1½ or 2 in. hose and attachments operating simultaneously. Breuer Electric Mfg. Co.

Hard Facing Electrodes

23 Added to a line of hard facing are two new tubular type shielded-arc electrodes; Faceweld No. 1 and No. 12. No. 1 deposits a chromium carbide type alloy surface and is used for hard facing parts of plain carbon, low alloy or manganese steel. It is designed to resist severe abrasion as well as moderate impact. Deposits of single layer have hardness of 40 to 52 Rockwell C. Multiple layer beads have hardness of 52 to 60 Rockwell C. No. 12 is an electrode of the same type as No. 1 but is designed for use where the hard faced surface must withstand extremely severe abrasion as well as some impact. The deposit is harder but not as tough as that of No. 1. Single layer deposits have hardness of 45 to 55 Rockwell C. Multiple layer deposits hardness is 55 to 64 Rockwell C. The deposits of both No. 1 and No. 12 maintain high abrasion and hardness values at red heat. Their corrosion resistance is comparable generally to that of stainless steel. The electrodes operate on either alternating or direct current. Lincoln Electric Co.

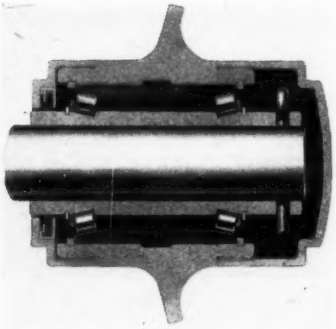
Vise Mounts

24 In production are two improved vise mounts, one mechanically operated for light work, and the other hydraulically operated for heavy duty work. Both Powrarms position work at any desired angle on a 360 deg horizontal or axial plane, or on a 180 deg vertical plane, and hold the work firm under great pressures. The tools combine the ball-and-socket joint principle with a simple, positive locking device that requires only slight pressure on a lever or hydraulic system to lock the work in any desired position. Work up to 150 lb can be held at any angle. Both Powrarm models are easily bolted to a work bench, or a special clamp

is also available to attach Powrarm to any convenient location in field or shop. The Powrarm enables the mechanic to tilt work instantly to the angle best suited for convenience and accuracy. It leaves both hands free, and eliminates the awkward, unnatural positions that cause worker fatigue and inaccurate work. Wilton Tool Mfg. Co.

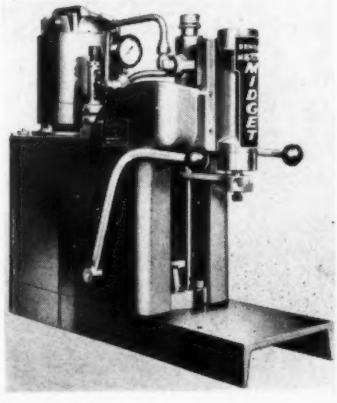
Duo Thrust Wheel

25 The new feature of this wheel is embodied in the newly designed radial Angular Roller bearing which combines the two important bearing functions in the same bearing, radial loading and thrust loading. The bearing itself is of the cartridge type. The inner race of the cartridge bearing is held stationary on the axle. Axle wear is absolutely eliminated and speed of installation, replacement and servicing of the bearing is thus stepped up. Bearings and wheels are interchangeable from inside to outside position. The disc wheel is cast of high quality aluminum alloy. The molded-on neoprene tires are impervious to oil, acids, fats and salt, and possess a hardness suitable for protection of floors and resistance to wear, but still sufficiently resilient to relieve operator fatigue when pushing loads over uneven or rough floors. Globe Co.



Hydraulic Press

26 Known as the Midget, this press offers a multi-purpose, oil-hydraulic press of 2000 lb capacity, complete with its own pumping equipment. Ram stroke, ram speed and ram pressure are all easily regulated by controls at the operator's fingertips. The Midget can be switched rapidly from one job to another, due to its highly versatile control and the ease with which tooling can be changed. Measuring over-all 13 by 30 by 29¾ in., and weighing only 270 lb, it can be easily moved anywhere in the shop. Small size and low initial cost make it ideal for use in batteries, for successive operation requirements, with all units independently controlled and operated. It can be adapted to other hydraulic machinery as an accessory unit, and may be operated in any position. The oil-smooth HydrOILic action exerts the same, exact preset pressure selected for the work regardless of size variations in the parts. The operator must



TOP OPERATING EFFICIENCY

FOR *at Reduced Maintenance Cost*

PRODUCT IMPROVEMENT...

PLANT ENGINEERS RECOMMEND

Schmieg DUST AND FUME CONTROL EQUIPMENT

Below is shown a 14000 CPM Centri-Merge Arrester Unit on a cast iron dust exhaust system.

CYANIDE FURNACES fume exhaust system is connected to a Centri-Merge Washer.

To Fit Both Plant and Product

Dust and fume control equipment correctly designed and manufactured is of vital importance to the safety and health of plant personnel, and results in product improvement. Schmieg engineers pioneered this principle of dust and fume control.

Plant engineers call upon Schmieg to design and build dust and fume control equipment to fit both plant and product. Typical installations by Schmieg include dust and dirt arresters, fume exhaust air washers, kerosene and welding fume exhaust units, stock and dust handling equipment in textile plants, cyclone collectors for brake lining dust, polishing and buffing dust collectors... to name just a few.

Schmieg dust and fume control units give you (1) reduced operating and maintenance expense, and (2) maximum efficiency in the removal of dust and fumes for improvement of working conditions and product quality.

DISC SANDING BOOTH Proper ventilation keeps dust from escaping to other parts of plant.

THE best AIR PURGE is CENTRI-MERGE

Our engineers will be pleased to consult with you in the solution of your proble

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. . . INCREASED PRODUCTION

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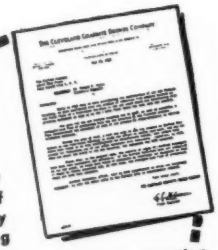
AND OBTAINED

STRAIGHT-LINE WORK FLOW

THROUGH VIBRATION CONTROL



Korfund Vibration Control for over 200 presses made possible Straight-Line production — and Cleveland Graphite Bronze Co. received Cleveland's Chamber of Commerce award as "The finest large industrial plant constructed in Cuyahoga County in 1941-42."

Early in 1940, when we were considering the construction of our new factory building, we were confronted with the problem of vibration from presses located on the first floor of a four-story building at the old plant which was interfering with grinding equipment as high up as the fourth floor, where the tool room was located.

Our plan for the new factory building was to have, as near as possible, a straight-line flow of production from the raw material to the finished product. This necessitated the placement of some of our presses in close proximity to various precision machines.

During the year of 1940, a test was made by placing presses on Korfund Isolators in the four-story building to study the effect on nearby equipment, and the results were found to be very satisfactory—so satisfactory indeed, that orders were placed for furnishing all of our press equipment with isolators. Therefore, in 1942, when our plant was moved to the new building, our equipment was 100% isolated.

Since 1942, to the present time, the results of using the Korfund Isolators have been very successful and effective. If the Korfund Isolators were not installed in our new plant, we would have found it necessary to rearrange our equipment so that it would be widely separated and, in that case, the straight-line flow of production would not have been possible.

Another favorable effect that we have experienced in using the isolating equipment, is that the noise level in the factory area is considerably reduced

Very truly yours,

THE CLEVELAND GRAPHITE BRONZE COMPANY

(Signed) L. E. Wilson, Plant Engineer

May 18, 1948

KORFUND VIBRATION ISOLATION reduces building damage, machinery maintenance costs, work spoilage, and provides the more quiet atmosphere that increases employee efficiency.
This is so, whether installed in an entirely new plant or under the worst offending machines in your present production line. No down-time is usually required, because Korfund vibro-isolators are quickly installed and adjusted. For detailed information, just send the coupon today.

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Please send me, without obligation, the 1948 Korfund Specification Sheet, describing Korfund Vibration Control Equipment—rubber, cork, and steel spring mountings—with Selector Chart for applications.

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Company_____

Address_____ City_____ State_____

depress both levers before the ram will descend, insuring that hands are away from moving parts. With a ram stroke of 6 in.; throat depth of 4⅝ in., and a daylight opening of up to 15⅜ in., coupled with a ram speed of 600 ipm up and 400 ipm down, the new unit is adaptable to an unusual wide range of operations, and permits an exceptional latitude in the use of special toolings and accessories. Donison Engineering Co.

Anti-Smudge Cone

27 Ceiling smudge, a frequent occurrence in air conditioning systems, particularly where sooty, smoky or dusty air is circulated or where there are rough textured, dirt-catching ceilings, may be effectively controlled by the addition of an Anti-smudge Cone to the Kno-Draft Adjustable Air Diffuser. Fitting

DIFFUSER AND CONE SEPARATED

snugly between the outer rim of the diffuser and the ceiling, the Anti-smudge Cone provides the precise minimum separation of the air stream from the ceiling and, at the same time, complements the appearance of the diffuser. In addition to inhibiting ceiling smudge, these units offer several other advantages. For example, Kno-Draft Diffuser with Anti-Smudge Cones require less space between the face of the duct and the finished ceiling. Moreover, the use of these cones provides far greater latitude between the ceiling opening and the outside rim of the diffuser. This means that less care need be taken in cutting ceiling openings, an advantage of particular appeal to the contractor. Rubber gaskets for the joints between cone and diffuser or ceiling are available. Anti-smudge Cones are furnished for both supply and combination supply-and-return Kno-Draft Diffuser from 4 to 18 in. neck diameter. W. B. Connor, Engineering Corp.

Magnetic Starters

28 Announced are new Bulletin 4111 Size 1 A C magnetic Starters for non-reversing, across-the-line starting of polyphase squirrel cage induction motors and single phase motors. These new a c starters, designed in accordance

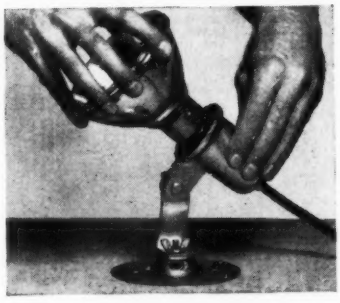
with Underwriters' Laboratories, Inc. and NEMA standards for industrial control, are available with open type construction or with NEMA Type 1 General Purpose Enclosures. They are suitable for use with separate pilot devices for 2 or 3 wire remote control, or can be supplied with local control pushbutton stations or selector switches. Starters have a minimum enclosed rating of 7½ hp, 440-550 v, 3 phase, 60 cycles. Standard operating coils can be

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 18-19 and 50-51

furnished for 110, 208-220, 440 and 550 v; 25, 50 or 60 cycle service. Dual voltage coils can be supplied for 110/220 or 220/440 v, 60 cycles. Ward Leonard Electric Co.

Lamp Holder

29 A new adjustable lamp holder has been announced. Designated as the Type L65P, the new lamp holder consists of a steel base and stand attached by means of a wing nut clamp to a die-cast zinc socket housing. The base is made to fit standard 3¼ in. and 4 in.



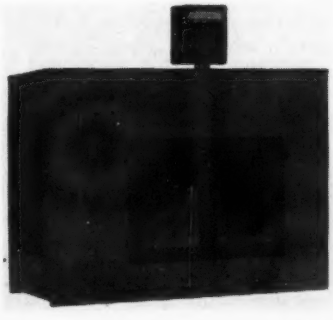
outlet boxes. The socket is sealed against moisture and dirt by a treated asbestos gasket molded to shape to gasket the joint between the 150 watt PAR-38 lamp and the holder. Lighting and Rectifier Div., General Electric Co.

Arc Welding Rod

30 A new low-hydrogen type coated electrode, No. 394, designed to prevent underbead cracking in weld deposits has been announced. This new electrode is one of the few of its type on the market today which operates on either a c or d c and is designed to give welds of 100,000 psi. It is anticipated that the electrode will find a wide market in the fabrication of hardenable stee's which are susceptible to underbead cracking when conventional types of electrodes are used without preheat. Extensive field tests have disclosed that No. 394 will do a completely satisfactory job on this type of material. Air Reduction Sales Co.

Laboratory Ovens

31 Design and production of a standard line of laboratory type industrial ovens is announced. Model KHD-145 bench type oven, is the largest of the line, and has interior dimensions of 30 in. high by 40 in. wide by 22 in. deep. All ovens in the line have an operating range up to 700 F, with accuracy guaranteed to within plus or minus 0.5 per cent. Model KHD-145 oven employs eight 1350 watt Chromolox resistance fin strip heating elements, and features con-

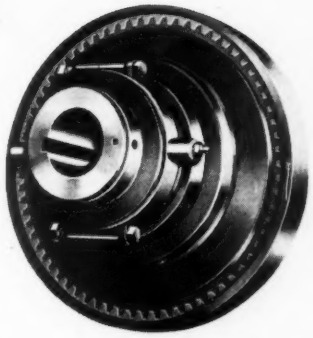


-AND HERE'S ANOTHER "FIRST" BY DODGE!

Here is another Dodge development which simplifies and improves power transmission machinery . . . the Rolling Grip Clutch. Toggles are *eliminated* by employment of ball and wedge principle.

Heavy power-transmitting pressure on the friction disc is developed by a circle of hardened steel balls which are forced into a wedge-shaped groove by the sliding cam.

The "wedge" of cam and groove contours multiplies the force exerted on the shifter collar into a powerful force on the friction disc.



Engagement is easy and positive — smooth as a rolling ball. Great flexibility, ease of control and extreme ruggedness are provided in this modern, compact unit.

ROLLING GRIP CLUTCH

Available in Bolted Plate or Gear Tooth Plate series — in sizes from .38 H.P. to 21.2 H.P. at 100 R.P.M. Write for special bulletin, A282.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana

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CALL THE TRANSMISSIONEER

He is your local Dodge Distributor — factory trained — qualified to suggest ways to improve your machine performance, increase production. Look for his name under "Power Transmission Equipment" in your classified phone book.

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trolled, forced-air flow to assure uniform and even distribution of heat throughout oven chamber. Temperature setting and control is provided by a Bristol electronic imput controller which can be of either control-indicating or of control-indicating and recording type. Oven controls can be mounted on oven, as shown, or at a separate location for remote control. Insulation is of 3-inch thick Magnesia. Double access doors have two thicknesses of heat-resisting glass which are separated by ¾ in. air space. Doors are gasketed with felt stripping. Safety features include flush-mounted switches and indicating lights, and electrical circuits that are automatically broken when oven doors are opened. An additional feature is the air directing holes located in oven interior which can be covered with snap-plugs to redirect air flow for flat or tall specimens, thereby increasing oven efficiency for special applications. K & H Industrial Products, Inc.

Switch Engine Improved

32 Recently announced are improvements in standard model 65 and 80-ton switching locomotives. The changes in the diesel-electric units give increased power and improved continuous tractive effort ratings. The new locomotives are each equippcd with two supercharged diesel engines with a maximum rating of 275 hp at 2100 rpm, or a total of 550 hp per locomotive. This is an increase of 38 per cent for the 65 tonner and 10 per cent for the larger model. The power actually delivered to the generators for traction is 420 hp. This compares with 330 hp in the old model 65 ton unit, and 440 hp on the old 80 ton locomotive. Maximum tractive effort has not been changed because there has been no change in the weight of the units. However, the continuous tractive effort ratings have been improved. The No. 747 motor with which the new locomotives are equipped is a self-ventilating, double reduction motor that replaces the non-ventilated single reduction motors used in the old models. The improved capacity of the No. 747 means that a certain tractive effort can be maintained for a longer period of time. The 747 rates 5200 lb tractive effort on a continuous basis. This is equal to 16 per cent adhesion on the 65 ton and 11.5 per cent on the 80 ton unit. The one-hour rating is 6200 lb, equivalent to 19 per cent adhesion on the 65 tonner and 13.8 per cent on the 80 tonner. These high ratings enlarge the field of application and makes it possible for them to handle the heavy jobs without blower equipment being added. Other improvements on the new models are clasp-type brakes and Pullman steps on the 65 tonner, standard on the 85 ton engine, hinged windows in front of the operating station; and a full metallic circuit with ground relay to provide a degree of protection from damage due to accidental grounding. General Electric Co.

Vacuum Cleaner

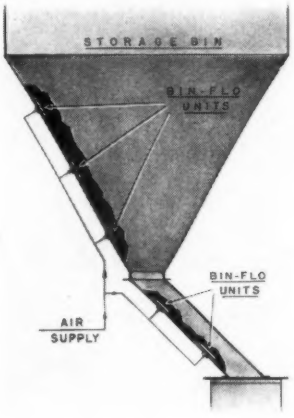
33 A new wet-dry vacuum, the MCV-255, with a capacity of 50 gal was designed for use on large industrial floors. The unit is powered by a 1½ hp, 100 v, 60 cycle a c or d c universal motor which gives the machine a water lift of 80 in. The motor is cooled by a separate air circulating system instead of by exhaust air expelled by the vacuum. It is mounted on a heavy duty, three wheel truck. All wheels have roller bearings. The front wheel pivots on ball bearings. A glass gage shows the content level. In the top of the drum is set a bronze wool filter built into a specially constructed dust chamber. The machine is emptied easily by pulling it over a drain and opening a large gate valve. Multi-Clean Products, Inc.

Control Valve

34 Newly-developed, a compact flow control valve, Model FC, is said to simplify machine operation. It is designed for more accurate, automatic control of the speed of a cylinder piston stroke without affecting the power of the cylinder. This flow control valve is positioned in the line between the operating valve and the cylinder, to control the speed of air being exhausted from the cylinder. For control of piston stroke speed in both directions, a valve must be piped into the line from both ends of the cylinder. Micrometer adjustment of a stem and specially designed floating bevel seat poppet maintains control at selected speed. Variable speeds are obtainable by adjusting the valve screw. Precision-built Model FC Valve is rust and corrosion-proof throughout. The body is of durable Naval Bronze, internal working parts are of stainless steel. Leakproof seat and one O-ring packing are of resilient, oil-resistant synthetic rubber. Model FC handles air, oil, or water pressures, 0-1000 lb psi. Six standard sizes, ¼, ⅜, ½, ¾, 1¼ in. Airmatic Valve, Inc.

Bin Aerator

35 Announced is Bin-Flo, a new aerating device to provide uniform and steady flow of bulk materials from bins, hoppers, and chutes. Bin-Flo provides a new and economical solution to the restriction and stoppage of bulk materials in bins and chutes. The Bin-Flo unit is a small plate 3¾ by 7½ by ½ in. thick which is readily located at points where flow is restricted. Low-pressure air



is injected into the material through a special fabric diffuser, causing the material to flow freely. Units will not plug-up even with the most finely ground material and are applicable to most dry, finely-ground materials. Bin-Flo can be used in conjunction with Bin-Dicators or they can be installed independently. Models are provided for thin-walled bins and chutes and for concrete and other thick-walled hoppers. Piping can be run either outside of thin-walled bin or inside of thick-walled container. The company will be glad to make suggestions and specify type of unit and mounting to meet different needs. Bin-Dicator Co.

Hand Tachometer

36 A new and highly accurate hand tachometer has been developed Transmission of the driving spindle rotation to the indicating pointer is effected in the first stage mechanically and in the second stage magnetically. Speed changes are indicated instantaneously. There is no time lag between speed changes. A rocker-arm arrangement effects the instrument pointer to always read in the same direction irrespective of the direction of rotation of the instrument spindle, that is, clockwise or counter-clockwise. The instrument pointer shaft is carried between two jewel bearings. A push-button device enables the operator to arrest the indicating pointer at the indicated reading, in a manner analogous to that of a stop watch, and to examine the instrument reading remote therefrom. By pressing the button on the opposite side of the instrument, pointer returns to zero. Instrument is made in three models. Each model has three ranges. The required range is selected by turning arrow on knurled knob to the range clearly marked on the instrument. Model ATH4 has a

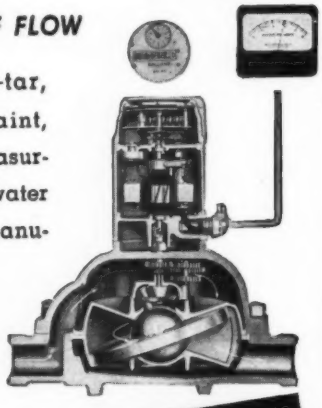
NEW

HAYS Veriflow
TOTALIZING-INDICATING
METER

Featuring

REMOTE INDICATION OF RATE OF FLOW

For practically all liquids—tar, molasses, crude oil, grease, paint, varnish, syrups, etc., etc.—for measuring, indicating, totalizing flow of water and chemicals in continuous manufacturing processes and numerous other uses. Its remote indicating feature is new—get the complete story.



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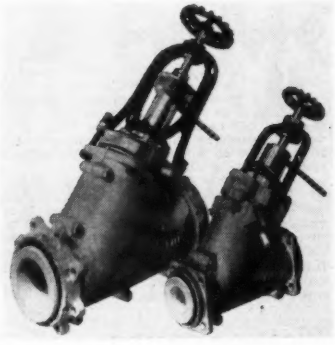
maximum range of 0 to 50,000 rpm or 0 to 25,000 fpm. Instrument accuracy is guaranteed to read within plus or minus 0.5 per cent. This accuracy is maintained over a wide range of ambient temperature variation by means of an ambient temperature compensating device built into the instrument. Equipoise Controls, Inc.

Porcelain Valves

37 Announcement is made of a new line of armored porcelain valves. In construction, these valves feature high-strength, heat-treated silicon aluminum armor. The body, plug, retaining rings, all parts with which chemicals can come in contact, are of solid, nonporous porcelain, a material of high corrosion-resistance. The addition of the armor provides protection for personnel and equipment against porcelain breakage from carelessness or accident. Armored



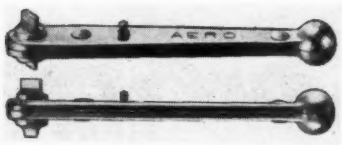
valves are recommended by the manufacturer for use in corrosive or contaminating applications. Armored Y valves are available in 1, 1½, 2, 3, 4 and 6 in. sizes. Armored angle valves in 1 and 2 in. sizes. Armored flush valves in 1½, 2 and 3 in. sizes for 3, 4 and 5 in. tank outlets respectively. Standard 125 lb flanges are integral with armor; porcelain faces are machine ground smooth and flat for gasketing. Process Equipment Div., Lapp Insulator Co., Inc.

Detergent Cleaner

38 A new liquid detergent has been placed on the market. This new detergent quickly and thoroughly cleans dirt, grease and grime. Under the name of Drex-Foam, this cleaning material possesses unusually effective cleaning and wetting properties so that the surfaces cleaned dry to a sparkling finish. It leaves no streaks, smears, or harmful effects on fine finishes or waxed and polished surfaces. This general-purpose detergent contains no abrasives or harsh alkalis that would scratch or dull surfaces or attack the skin of the user. As it is highly concentrated, most cleaning applications require the use of only 1½ to 2 oz to a gallon of water. On metals and painted surfaces, a pre-rinse with plain water may be used, and while wet, the dilute solution is sponged or flooded on the surface. The solution may be used either warm or cold. Dirt, soil and grease are immediately removed in swirls of protective foam and bubbles. The surface is then merely flushed with clean water. Detrex Corp.

Ratchet Screwdriver

39 A new screwdriver is designed to permit the application of leverage to drive screws, and to reach into areas inaccessible to common screwdrivers. The ratchet permits use of this tool in confined spaces and the reversing lever makes the tool suitable to drive or remove screws. The screwdriver has two blades, one for large and one for small screws. It has a ball end grip to prevent injury to hand. Overall length is



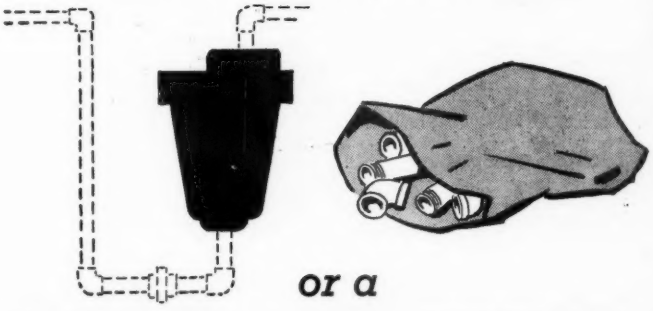
3⅞ in. The standard tool is made for slotted screws only. It is available with special drivers for Reed & Prince, Phillips and other screws for assembly operations. Price, 59 cents. Aero Tool Co.

Acid Pump

40 Safe and convenient transfer of acids and other liquids from carboys, barrels or drums is now possible with the improved foot-or hand-actuated pneumatic pump. Liquids flow smoothly and stop instantly. They come in contact only with the corrosion-resistant tube and cannot affect other parts. No tilting of the container is necessary and

?

A Conventional Steam Trap and a BAG of fittings



or a

SUPER-SILVERTOP

The savings you realize by using Super-Silvertop Steam Traps are more and more important in today's market as costs keep climbing. The water seal or U-tube built into each Super-Silvertop saves you as many as eight fittings—it also saves up to an hour of installation time per trap. And you pay no premium for this simplified piping economy, there is no extra charge for this superior trap engineering.

Over 58 years of steam trap manufacturing back up this Super-Silvertop design—a design that for years has proved that Super-Silvertop is a "long-life", trouble-free trap. Let us send you full details, contained in the book, "How To Choose A Steam Trap", a free, helpful reference work regardless of what trap you use.

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Motor-operated

KINNEAR DOORS

respond with magic ease to push-button control

It's sheer magic the way you can shave manpower losses and plug profit drains at doorways with Kinnear Steel Rolling Doors. A split-second and mere fingertip pressure are all the time and effort needed to start or stop these doors equipped with rugged Kinnear Motor Operators. Any number of push-button stations can be placed at strategic points —at door jamb for on-the-spot operation and elsewhere for step-saving remote control. And any number of doors can be operated from a single station.

The prompt, glide-smooth door action is possible because the Kinnear *interlocking-slat* steel curtain *lifts vertically* and coils compactly above the lintel. Openings remain completely clear. All surrounding floor and wall space is usable. This tough, flexible, all-metal door protector withstands years of weather attacks; resists fire and theft. For a better check-rein on profit leaks in plant operation, rely on efficient, economical Kinnear Steel Rolling Doors. Built any size, for installation in old or new buildings. Write for more facts today.

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Saving Ways in Doorways

KINNEAR
ROLLING DOORS

danger of a slip, a splash or a spill is minimized. When removed, from container, liquid drains completely. Pumps with lead tubes are suitable for sulphuric, hydrochloric, hydrofluoric acids and many others. Price, $11.30 complete. Saran plastic tubes are recommended where pump is to be used in nitric, muriatic, citric, phosphoric, acetic, bleaches and others. Price—$12.80 complete. General Scientific Equipment Co.

Floor to Floor Lift

41 Fully adjustable for width, length and pitch of stairway, the Stairlevayor can also be used as a lift over present wood or concrete stairway or in any open space, with or without steel treads, inside or out. Push-button controls at every floor level enable it to pay for itself through elimination of a trained operator. It can be erected as desired,

One ton or more from floor to floor!

Use over existing stairway.

Immediate installation. Built-in steel stairway optional.

either with a small wedge-shaped recess at the stairway base or in conjunction with a short ramp, and is easily set up ready for operation in less than a day. No special shaft space or reinforcement is needed. Safety factor is 5 to 1, plus 45 deg angle stress to reduce load weight by one-half. Available with or without steel stair treads. Complete with motor, cables, automatic limit switch and electric brakes. Moto-Flow Co.

Chain Saw

42 A new light-weight engine-driven chain saw, with all-purpose chain for fast ripping or cross-cutting, has been announced. The power unit is a special magnesium die-cast engine, with full-swivel bevel-gear transmission. The cutting unit is composed of a stainless-steel laminated blade, available in lengths up to 5 ft, and a rip-cross chain. The saw is designed for either one-man or two-man use. The 2 cycle power unit is a completely new design. The complete engine and transmission weigh only 38 lb, developing a full 5 hp. Blades and chains are of; 20, 36, 48 or 60 in. Blade angle adjustments may be made through 360 deg. McCulloch Motors Corp.

Self-Winding Reel

43 A self-winding reel that suspends portable tools for use, and raises them out of the way when they are not needed is announced. Known as the Zoo self-winding balance reel, it speeds production and reduces fatigue by keeping such tools as power screw drivers, nut runners and drills always within instant reach of the worker for easy use. It helps keep costs down by eliminating accidental dropping and other rough handling of tools. The Reel is hung from a beam or a cable in work position above the operator. The power tool is fastened to the end of a 6 ft cable wound on a drum within the housing. The operator simply pulls the tool down for use when he needs it, raises it out of the way when he has finished the job. Reel tension is regulated to balance any tool weighing up to 10 lb. Tension nut and lock are located on the same side of the reel housing for quick adjustment. The reel is mounted within a heavy duty cast aluminum alloy housing that is dirt and dust proof. Oilless bearings eliminate maintenance. The cable outlet is located at the side of the housing, so that the cable leaves and enters in a straight line, minimizing strain and wear. Aero-Motive Mfg. Co.

Variable Transmission

44 A new transmission called Specon MD, designed to provide infinitely variable speeds within wide ranges is announced. The unit consists of a mechanical differential attached to a standard Link Belt PIV unit. Four models are offered, providing any desired speed, either forward or reverse, between 0 and 7000 rpm. Output torque from 20 in. lb to 15460 in. lb is also available. Net output horsepower varies in different models and speeds from 1 hp to 20 hp. Desired speed is set by a hand wheel and indicated on a large dial. A vernier dial is provided, when specified, to permit extremely close speed settings. Related speed-torque characteristics within the extreme limits may be provided to fit almost any applications. Speed Control Corp.

Registration Control

45 Introduced is photoelectric Registration Control Type 23LF3 for maintaining accuracy in high-speed printing and cutting operations on paper, cellophane, fabrics, steel, tin, aluminum, or other sheet material. It is recommended for all types of automatic packaging, printing, labeling and cut-off machinery. Registration Control Type 23LF3 combines extreme sensitivity with high speed operation. The cricuit will respond to impulses as short as 1/1000 second. Light source and phototube are served by a single lens, handling both transmitted and reflected light. It operates from both opaque and transparent web materials. It controls from either light or dark registration marks. It may be used to control practically any type of correcting means on both continuous and intermittent feed machines. Photoswitch, Inc.

Gravity Oilers

46 Multiple oilers offer steady, reliable drop feed oiling to multiple points and combine compactness with attractive appearance in an exclusive design. Oil is fed by gravity from a reservoir through multiple gang mounted sight feed valves to a number of individual bearings requiring lubrication.

One of these oilers can replace from 2 to 24 individual oilers and many advantages are offered by this central method of lubrication. There is only one reservoir to fill, one shut-off lever to operate and oil fed to each bearing can conveniently be adjusted and observed at one station. Each is equipped with either ¼ in. or ⅜ in. O.D. tubing. Oil-Rite Corp.

Plastic Coating

47 Krylon is a transparent plastic coating that is supplied in a self-contained handy compact sprayer. All that is necessary to release the plastic spray is to press the button on the top of the can with the index finger. The result is a fine spray of durable, colorless plastic material forced out under pressure in such a way as to provide a clear, protective coating that will adhere to practically any product. The coating itself dries in less than a minute, leaving a clear finish that retains the flexibility of the material on which it has been applied. This flexible plastic coating has outstanding resistance to discoloration at high temperatures, water, alcohol, alkali, acids, mineral oils, grease, and chemical fumes. Foster & Kester Co., Inc.

Tote Box Truck

48 The double-hook feature enables the hook-arm to bite into totally closed wood boxes or cases; or into open boxes; while the upper hook conveniently takes hold of handles on metal

tote boxes, etc. Easy manipulation of the book-arm is made possible by the convenient hand grip on the arm itself. When the load is hooked, the operator merely pulls backward and the load slides easily onto the balanced tilting carrier plate. Bulky boxes can be tumbled onto the carrier plate. The powerful leverage principle employed reduces the operator's effort to a minimum. To discharge, a slight push with the hook-arm overbalances the carrier plate and allows load to slide gently to floor. The tilting carrier plate is constructed of parallel steel plates and is balanced so the forward movement of the hook-arm places it in loading position. In pulling position or when a load is being hauled, the carrier plate is automatically tilted back off the floor. Of rugged, all-steel welded construction, the Hook-'N-Haul is equipped with one swivel and two stationary casters, either steel or rubber, and can be easily turned in its own axis. Painted fire-engine red for quick locating when needed. Techtmann Industries.

Soft Solder

49 This new indium-lead alloy, No. 50, which contains no tin, was developed to meet the demand for a solder with a melting point midway between those of the tin-lead solders and brazing alloys. The new solder melts at 600 F, exhibits an extremely short plastic range, and has an exceptional wettability factor. Extensive premarketing tests indicate a holding strength of 3500 psi, and a tensile strength of 5200 lb, with a very high degree of ductility. It is now available in all standard wire gauges, as well as ribbon form. It may also be ordered to specifications in preformed shapes, such as rings, washers, pellets, discs. Soldering Specialties.

Marking Paint

50 A new traffic paint based on Pentalyn 802A, a synthetic resin, and Parlon, chlorinated rubber, is said to be outstanding in both durability and rapid dry. The prime requisites of traffic paints are rapid speed of dry and durability. This is particularly true of intersection cross lines where the paint is subjected to the most traffic wear. Traffic paints based on Parlon and Pentalyn 802A are outstanding both from the standpoint of durability and speed of drying. Drying speeds of these paints vary from 11 min. to 20 min. depending on such factors as thickness of film and type of solvent. The fast drying time reduces the amount of time traffic has to be rerouted. The outstanding durability means fewer applications per year with consequent savings in man-hours and paint gallonage. When applied with conventional type traffic-marking equipment on asphalt surfaces, these paints do not cause bleeding. Hercules Powder Co.

Steel Shelving

51 Steel shelving which can be assembled to form a wide variety of units has been announced. The basic parts from which the steel shelving is constructed consist of four posts with 36 or 24 in. wide shelves in either 12, 18, 24 or 36 in. depths. Posts are available in 87, 84, 48, 45 in. and 39 in. heights. Open shelving can be quickly constructed from these basic parts. End and back panels of the required size can be provided for making closed shelving. Shelf dividers are available to make the unit into any type parts bin. Necessary nuts and bolts for assembling are included in the shipment.

All shelves are 18 ga prime steel, backs and sides are 22 ga, and posts are 13 ga. Tri-State Metal Products, Inc.

New Methods of Storage Tank Support

(Continued from page 45)

nuous concrete manhead runs across the top of the tanks.

Here, too, the continuous foundation slab and concrete cradle were replaced by single footings, carrying the tanks on lugs together with the columns for the manhead above.

Lugs welded to horizontal storage tanks to support them on single footings and piers reduces the costs for material and labor considerably, and also improves their maintenance.

Following is a breakdown of all items which are influenced by this arrangement in comparison with the customary design.

A quick inspection of these two comparisons show positively the superiority of the savings over the extra costs for the lugs.

In the case of the tankfarm shown in Fig. 3, comparative estimates promise savings of about $3,000.00.

Yet this case cannot be considered as an average example, because of unfavorable soil conditions, and because for ⅔ of the structure the heavy load of the superstructure prevented a further reduction of the footing sizes. In comparison with the general savings the extra costs for the lugs are small.

This is especially important for thin walled structures where improper supports can produce excessive stresses and deformations. The lugs can be made and welded to the tanks reliably by the tank manufacturer. All the general contractor has to put in are simple footings and piers, such as he provides for any other construction.

This article is one of the prize-winning entries in the James F. Lincoln Arc Welding Foundation "Design for Progress" competition for 1947. Considerable design data was incorporated in the original paper but has been deleted here because of space requirements.—Editor.

TRIMO-ALLOY

INDUSTRY'S BIG, TOUGH, ALL-ALLOY STEEL

PIPE WRENCH

DROP FORGED

Whatever size Trimo-Alloy Pipe Wrench you need, buy and use, you get "oversize" power and durability—because it's the only wrench on the market that is entirely made of drop forged alloy steel. The teeth are hardened by modern induction heat-treatment—and the whole wrench is tough in the right places to stand tremendous stress. Trimos are the most powerful wrenches ever built for industry. Put them to work wherever other wrenches are found wanting.

TRIMONT MANUFACTURING CO.

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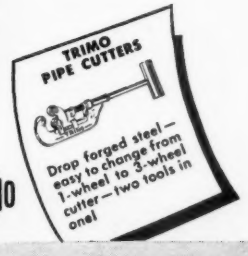
- Only Trimo Pipe Wrenches are manufactured throughout from alloy steels.
- Only Trimo Wrenches have teeth hardened by modern induction localized heat-treating process to close Rockwell specifications.
- Tests prove Trimo drop-forged steel handle capable of bearing strains up to 40,000 inch-pounds — more than double that of cast malleable handles in same size wrench.
- Trimo's frame design is on the efficient "knee-action" principle — making possible one-hand use on otherwise two-hand jobs.
- Replaceable lower jaw saves buying complete new handle after the wear of extended use.



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Anyone can measure insulation resistance in generators, motors, wiring and other electrical equipment with a "Megger" Insulation Tester . . . quickly . . . easily. Merely make connections, turn the crank and read the position of the pointer over the scale. The "Megger" instrument shown above consists essentially of a direct-reading ohmmeter mounted with a constant-voltage d-c hand generator in a rugged molded plastic case, easily carried by hand. Requires no outside power supply.

Bulletin 21-45-F.

PLUG-IN TYPE

The *rectifier-operated* "Megger" Insulation Tester—especially useful where a number of tests are to be made at one time. Simply connect to 115 volts a-c, flip a switch and proceed to make tests. Ratings up to 1000 megohms and 1000 volts. Bulletin 21-46-F.

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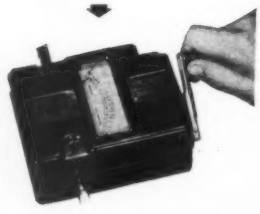

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Plant Engineer's Library

Sheet and Plate Metal Work*

Practical Sheet and Plate Metal Work by E. Arthur Atkins. Size 5½ by 7¼ in.; 606 pages; illustrated. Published by Sir Isaac Pitman & Sons, Ltd. Price 10 shillings 6 pence.

THIS LITTLE BOOK is really a handy book to have around the sheet and plate metal shop. Discussions in it deal with the making of patterns and laying out of the metal to be cut. Numerous sketches, drawings, and photographs show how to perform all the above steps. The type of work done ranges from the simplest bend of square pipe to complicated layout jobs requiring detailed drawings and patterns. Chapters on surface treatment, metals and their properties, annealing and welding, corrosion of metals, machines and tools for performing the cutting and bending, particulars of metals and alloys, make this a technical book from the broad standpoint as well as practical from the layout standpoint. Book should be valuable for boiler makers, braziers, coppersmiths, iron-workers, plumbers, sheet metal workers, tinsmiths, whitesmiths, zincworkers, and others who might require a knowledge of the working of metals or surface treatment.

Electrical Insulating Cloths*

Varnished Cloths for Electrical Insulation by H. W. Chatfield and J. H. Wredden. Size 5½ by 9 in.; 233 pages; illustrated. Published by Chemical Publishing Co. Price $6.00.

THE AUTHORS have, in this book, tried to present all the more pertinent facts gathered from many places concerning varnished electrical cloth. This was the purpose of the book to gather all the facts and put them in one place for handy reference.

The book tells the manufacturer of the cloth what happens to his product, and the properties that the users desire or are trying to attain. For the varnish maker something of the textile supports on which his is applied, and how the varnish contributes to a flexible electrical insulator. To the proofer, a little of the two raw materials which he incorporates into one and how his work can be the deciding factor in a good insulation, and finally for the electrical engineer and designer real basic information on the materials he has to incorporate in his product. For this man there is discussion on the varying qualities and electrical resistance of different cloths and the impregnating varnish. Quite interesting are the results of dielectric tests which were run on many materials.

Supervisory Management*

Essentials of Management for Supervisors by Charley H. Broaded. Size 5½ by 8½ in.; 231 pages; indexed. Published by Harper & Brothers. Price $3.00.

THIS BOOK was designed to supply the minimum information about general management, its organization and function, which should be understood by all members of the supervisory force, including the plant engineer. Each phase of business activity is reduced to its basic principle, procedure or technique. Fundamentals of overall planning and control, of dealing with employees, of work simplification and of supervisory instruction are clearly examined and explained. Throughout the book case examples are used to show, from actual experience, what is accomplished when these fundamentals are, or are not, followed. A complete series of check charts is provided for use in execution of the

policies and procedures outlined. The author has had wide experience as a worker, as a foreman and as a supervisor of industrial training for the California Board of Education, the Air Service Command and other West Coast organizations. He was first president of the Training Association of Southern California. He is now supervisor of Foreman Training for the Union Oil Company in Los Angeles.

Elementary Structures*

Stress Analysis and Design of Elementary Structures by James H. Cissel. Size 5½ by 9 in.; 364 pages; an appendix of 50 pages and an index. Published by John Wiley & Sons, Inc. Price $5.00.

THIS BOOK was written primarily for use in a comprehensive structural course for non-Civil Engineers. The author has revised the specification material to conform to recent recommendations of American engineering associations and he has also added a new chapter on the design of light gage steel structures.

Among the subjects covered in the book are external forces and loads; graphic statics; reactions, shear, bending moment; restrained and continuous beams; trusses; stability of masonry structures and foundations. Part II covers the design of simple structures which include structural fastenings and connections; timber beams and columns; steel tension members, columns, beams and girders; light gage steel construction; and reinforced concrete beams, slabs and columns.

How To Do It

Technique of Systems and Procedures by H. John Ross. Size 7 by 9 in.; 328 pages; a glossary and index. Illustrated. Published by Office Research Institute, Inc., 60 E. 42nd Street, New York 17, N. Y. Price $15.00.

THE MATERIAL used in the lectures upon which this book is based has a foundation on actual practice in industry. As the author points out, however, it would be misleading to leave the impression that everything in the book is being followed in detail by any one organization. The entire book is devoted to the author's conception of sound systematization of office procedure. As he points out, it is estimated conservatively that the office or clerical function is at least 20 years behind the factory. One of the objectives of the book is to provide a practical guide to systems techniques. The entire book is based on a rather broad background of functions which are common to all businesses. The author, apparently, has not attempted to detail each procedure but rather to give the overall background necessary before procedures and systems can be set up.

The chapters of each section are summarized at the end in order that by the means of repetition the basic fundamental lesson in each chapter will be repeated. Line drawings, sketches and cartoons are used effectively throughout the book to point up the object lessons brought out by the author.

Budgeting Control*

Budgeting for Management Control by Floyd H. Rowland and William H. Harr. Size 5½ by 9¼ in.; 370 pages; illustrated and indexed. Published by Harper & Brothers. Price $4.00.

WHETHER the business organization is small or large, newly organized or long established, this book gives complete and basic methods for budgeting control, usable in all phases of business. Budgeting is lifted from a treasurer's function to the status of management program and an entire business activity brought to a focus in one volume. It shows how to prepare a budget on an annual basis and adjust these annual plans in terms of day to day conditions. One chapter in the book will be

An asterisk (*) following the title of any book described in this department indicates that the book may be purchased from the Book Department, PLANT ENGINEERING, 53 W. Jackson Blvd., Chicago 4, Ill.

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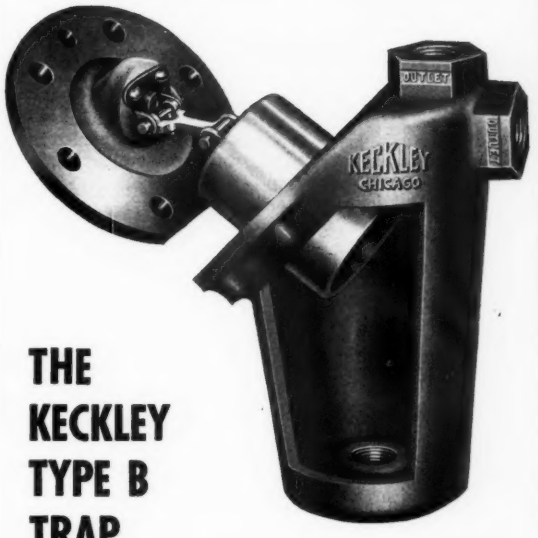

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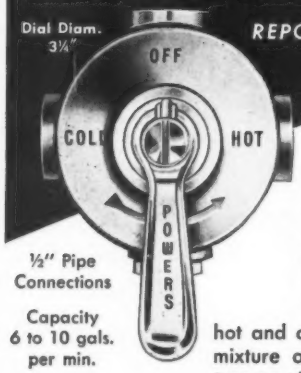

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of exceptional interest to a plant engineer — Chapter XVI, which titled "The Plant Budget."

The senior author, a recognized authority on budget control, has served more than 44 industries in his nearly quarter of a century professional practices and is now one of the partners in organizing the Management Controls Associates. Mr. Harr is the Budget Director and Assistant Treasurer of Simmonds Aerocessories, Inc., whose experience in this field extends over ten years.

Standards Index*

Index to A-S-T-M Standards, December, 1947, 248 pages, size 6 by 8½ inches, paper covered; published by the American Society for Testing Materials, 1916 Race Street, Philadelphia, 1948.

THIS Index is an adjunct to the Book of A.S.T.M. Standards and comprises a ready reference for locating any A.S.T.M. standard in the bound publication of the Society in which it appears. The Index should also be of value in ascertaining whether the Society has issued a standard on a specific subject. It enables any of some fifteen hundred standard specifications and tests in the volumes of the A.S.T.M. to be located readily. All items are listed in the index under appropriate key words according to the particular subject they cover. As a convenience a list is given of the specifications and tests in numeric sequence of their serial designation. Copies of this 248 page publication are furnished without charge on written request to A.S.T.M. Headquarters, 1916 Race Street, Philadelphia 3, Pennsylvania.

Bulletins . . . . . Catalogs

ELECTRICAL

101 Power Factor — "Power Factor and What to Do About it," is a new 20-page, pocket-size booklet (No. 200-TEC-1077) explains the essentials of power factor in industrial plants, gives a digest of power factor calculations, why low power factor should be corrected and tells how it can be done. Electric Machinery Mfg. Co.

102 Slide Rule—A slide rule for selecting distribution systems in industrial plants has been issued. One side of the Rule presents a table which indicates relative standing or gradings of 11 different distribution systems rated on "Flexibility", "Service Continuity", "Regulation", "Efficiency", "Operation and Maintenance Cost", and "Investment." Weighted numbers, indicative of the relative importance of these various factors in YOUR plant may then be assigned by you. Reference is then made to Table II by inserting the slide in the rule. The factors to which you have assigned the greatest importance will then appear in color blocks under the various headings. Westinghouse Electric Corp.

103 Transformers — Transformers for all classes of service are now available with the company's non-inflammable insulating liquid, according to Bulletin 61B6043A. The bulletin points out how transformers filled with this liquid are especially suitable for installation in locations which would require a fireproof vault if other types of liquids were used. Allis-Chalmers Mfg. Co.

104 Electric Plants Reference Manual—A 20-page book on Electric Plants has just been issued. The book, Form A138A, contains information on Choosing the Proper Type, Choosing the Right Size, and Choosing the Starting Method. General information tells wattage required by various types of appliances and equipment, wattage required by motors. Complete descriptive data are presented on the various generating sets. The booklet is well illustrated and filled with tables and engineering information. D. W. Onan & Sons, Inc.

105 Installation and Care of Dry Type Transformers—Bulletin 61X7088, 16 pp., covers unloading, installation, storage, drying coil and core, maintenance hints, and description of accessories and wiring diagrams for thermal control. Switch plate and terminations information is given. Sketches, photos and charts illustrate text. Allis-Chalmers Mfg. Co.

106 Magnetic Starters with Circuit Breakers—Bulletin 4130, 4 pp., describes and illustrates with photos and specification tables these combination a c magnetic starters with circuit breakers. Heater selection tables are given. Ward Leonard Electric Co.

Mark the numbers of the bulletins you wish to receive on the no obligation, no postage card between Pages 18 and 19 and 50 and 51

107 **Small Battery Chargers**—This catalog sheet describes and illustrates the; home charger, trickle charger, fast charger, and 1-12 battery charger. Richardson-Allen Corp.

108 **Heavy-Duty Synchronous Motors** — Bulletin 1100-PRD-181, 8 pp., describes and illustrates these motors available for high speed operation from 30 to 5000 hp. Cutaway sections show features of construction. Photos show various parts. Electric Machinery Mfg. Co.

109 **Load Centers and Service Equipment**—Bulletin No. 202, 8 pp., presents the various types of load centers suitable and not suitable for service equipment. All sizes, dimensions, wiring diagrams, ratings, weights, and list prices are given. Frank Adam Electric Co.

110 **Polyphase Induction Motors** — Bulletin 604, catalog sheet, presents general data and special features of these polyphase induction fractional hp a c motors of 1/6 to 1 hp. Robbins & Myerrs, Inc.

111 **Synchronous Motors** — Bulletin GEA-5063, 4 pp., briefly presents the high and low speed synchronous motors for the lumber, pulp, and paper industries. Application photos show use of these motors in these industries. General Electric Co.

112 **Plug-In Strip** — Catalog No. CF-2, 8 pp., describes the plug-in strip for electrical outlets, illustrates the various parts and tools, and shows with sketches how to install the strip. National Electric Products Corp.

113 **Insulated Wires and Cables** — Handbook and Catalog No. 10-F, 96 pp., illustrates and describes wires, cables, and flexible cords designed for use where wiring is exposed to heat, corrosive fumes, grease, oil or fire hazard. Book contains Electrical Code data as applied to products. Rockbestos Products Corp.

PUMPS, FANS, COMPRESSORS, DUST CONTROL

114 **Industrial Dust Control**—A veritable handbook on industrial dust control is Bulletin 98. Among the various divisions of engineering informations are: What is Dust Suppression? Dust Filter Specifications, Dust Control Systems, Automatic Controls. The bulletin is illustrated with very fine line drawings and photographs and much tabular material presents information in compact form. The W. W. Sly Mfg. Co.

115 **Jet Blowers**—Steam jet blowers and blast nozzles for moving large volumes of gas at low drafts are described in Bulletin 4-AB. Tables, charts and drawings give complete data on dimensions, connection sizes, capacities and costs. Colored diagrams, with explanations, are used to illustrate typical applications of various types of blowers and blast nozzles. Schutte & Koerting Co.

116 **Corrosion Resisting Pumps**—Bulletin 815, 20 pp., describes the newest design features and illustrates with complete exploded views. Many cross-sectional views and drawings also serve to explain construction. Duriron Co., Inc.

117 **Centrifugal Pumps**—Bulletin 1020, catalog sheet, presents data on the general construction and capacities of this double ball bearing centrifugal pump. Yeomans Brothers Co.

118 **Standardized Compressors**—This 8 pp., bulletin is arranged to be folded out. Shown are the 48 different models which can be constructed from 18 parts. Also the special features of different parts which make this possible. Air-Flo Compressors Co.

119 **Air Handling Equipment**—Catalog 481, 32 pp., contains information concerning equipment for dust and fume control, spray booths, washers, ovens, and others. Engineering tables and charts are presented on; gas friction, Area and circumference of circles, cfm through collecting hoods, weight of galvanized pipe, dimensions of wrought steel pipe, water discharge through orifices, and flow of gas through pipes in cfhr. Schmieg Industries.

120 **Spray Booths** — Catalog 480 describes and illustrates the operation and application of these water wash spray booths in various plants. Photo and blueprint reproductions are used to show construction and flow of water, air and paint laden air. Schmieg Industries.

121 **Two Cycle Radial Dual Fuel Engine** — Bulletin 155, 6 pp., describes and illustrates with photos, drawing, and disassembly photo this engine which is something new in stationary practice. Engine develops 1800 hp. Lubrication and other points discussed. Nordberg Mfg. Co.

122 **Condensate Pumps**—Catalog Section 199 describes this company's packaged condensate return units. Containing 4 pages, the section gives complete engineering and dimensional information and illustrates the units. Roy E. Roth Co.

123 **Fan Data** — "Physical Proportions of Commercial Fans," is the title of a new 4-page booklet Form X-12. It has been produced by this Association as a service to architects, engineers, and others. The Form is used in conjunction with the NAFM's "Standards." National Assn. of Fan Manufacturers.

124 **Bag Type Dust Collectors**—Bulletin No. 163-4, 4 pp., describes and depicts with cutaway view, dimensional drawing and table, and illustrations of certain parts, these standard bag type dust arresters. Northern Blower Co.

ROPE AND RIGGING

125 **Wire Rope Questions**—Bulletin 21, 4 pp., contains 20 questions and their answers on wire rope construction, materials, and application. This is preformed rope. Braided wire slings also are discussed. Macwhyte Co.

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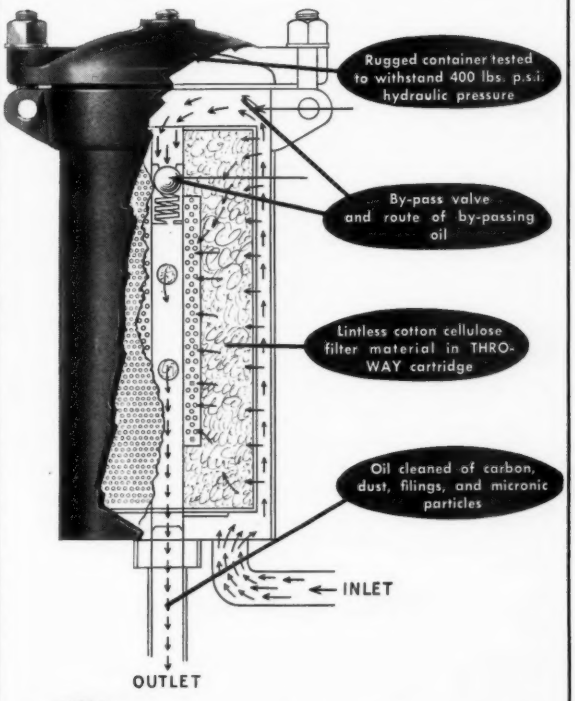
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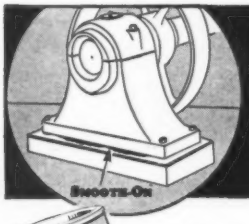

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126 Rope and Rigging Handbook—An exceptionally good job has been done by the issuing company on this rope, rigging and cordage handbook. Containing 32 pages with a heavy cover of varnished stock, the book describes the early history of rope and cordage, tells of its use in industry, the marine field, on the farm, etc., gives a guide to "Proper Line Sizes," presents a section "How to Select Rope," a chart for "Matching Rope to Block," tells about considering sheave friction, allowing for sling angles, presents several pages on "How to Rig Block and Tackle," "How to Uncoil Rope," "How to Care for Rope," "How to Splice," "How to Tie Useful Knots." A weight and strength chart is included. All sections are very well illustrated. American Mfg. Co.

INSTRUMENTS, CONTROLS

127 Speed Must be Measured—28-pages in Bulletin 35 are devoted to compact, concise descriptions and explanations of why speed measurement is important, the various types of instruments needed and available for making speed measurements, complete descriptions of these instruments, specifications, cases and parts. The various types of instruments covered are: resonant reed tachometers, frequency meters, rate of vibration indicators, hand tachometers, chronometric speed indicators, tachoscope, tachograph and tachonorm. James G. Biddle Co.

128 Multi-Record Recorder—Bulletin 428 tells about this company's Dynalog Recording instrument. Colored illustrations depict graphically what happens when the recorder operates. Listings of advantages and uses of the instrument are given. The Foxboro Co.

129 Air Actuated Control—A complete air-actuated control system of advanced design is presented in this 24-page Catalog ND4B. Diagrams and test curves show how the system provides proportional action, automatic droop correction and stabilized rate action. Illustrations show many interesting features of the system. Leeds & Northrup Co.

130 Smoke Recorders and Overfire Jet Controls—Bulletin No. 20-A, 8 pp., describes and illustrates profusely with photos dimensional drawings, and sketches the electronic smoke indicators, recorders and overfire air jet controls. Brooke Engineering Co., Inc.

131 Electronic Controls—Bulletin Z6500, with price list, 8 pp., is condensed catalog describing and depicting indicators, controllers, recorders and combustion safeguards. Wheelco Instruments Co.

132 Sewage Treatment Instrumentation—Bulletin No. 7301, 43 pp., presents both applications and instruments with schematic drawings, photographs, and dimensional drawings. Instruments are; electric and mechanical flow and liquid level meters, pneumatic remote transmission systems, thermometers, pressure gages, recorders and indicators and others. Brown Instrument Co.

133 Electrical Process Control—Bulletin No. 6148, 12 pp., presents a number of problems in process control with which this firm had to cope and explains how they did utilizing their equipment. Photos, sketches, Drawings illustrate problems and solution. Richardson Scale Co.

134 Transmitting Pressure Measurements Electrically—Catalog R-10, 8 pp., contains detailed engineering and application data on indicating or recorder type instruments. Schematic sketches illustrate application to measuring variables such as density, flow, weight. Automatic Temperature Control Co., Inc.

135 Remote Controls — Bulletin No. 800-B, 16 pp., describes the various manual and automatic remote control applications of expansible tube valves. Manual includes data and diagrams of typical arrangements. Grove Regulator Co.

136 Gas Analyzers — Bulletin No. 213, 8 pp., describes and illustrates the construction and application of these analyzers. Step-by-step sampling procedure is shown. These are intended for CO, CO_2, O, H_2O, and Methane. Burrell Technical Supply Co.

137 Recording and Indicating Pyrometers—Catalog No. 1101J, 40 pp., describes and illustrates with application photos, disassembly photos and recording and indicating pyrometers offered. Specifications for each are given. C. J. Tagliabue Corp.

138 Flow Measuring Tubes—Bulletin A5, 6 pp., combines cut-away views and engineering drawings to describe in detail the principle on which flow tubes operate. Curve and logarithmic charts illustrate calibration. Bethlehem Foundry and Machine Co.

MAINTENANCE

139 Industrial Protective Coatings—Bulletin MC-2, 4 pp., presents the typical applications for which this coating is suitable and lists the typical materials it resists. Back cover also lists other series of coatings. United Chromium, Inc.

140 Corrosion Test Strip—Information Circulars 1 and 3 summarize the use of the step plated bearing corrosion strip to measure the onset of corrosion characteristics in lubricating oils during use. Randall and Sons.

141 Corrosion Resistant Coating and Wrapper—This bulletin gives complete details about a wrapping product which combines a corrosion-resistant coating and wrapper for use on lead-sheathed cable in manholes. Dearborn Chemical Co.

142 Bonding Cement — This 6 pp., folder gives instruction on the application of this compound for bonding walls of concrete or plaster. Camp Co.

143 Industrial Protective Coatings — This 12 pp., bulletin gives detailed information on protective coatings to stop corrosion. Each product offered is listed with specifications and possible applications. Mixing and thinning instructions are included. Various types of applications are depicted. Tar Products Div., Koppers Co., Inc.

144 Protective Coating Color Sheet—Bulletin C34 presents the colors in which this product is available. Listed are

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some of the firms which have used it. Arco Co.

145 Floor Care — Prevention of "dusting," produced by trucking and hard wear on concrete floors, is explained in this new 6-p folder. The dangers of the dust are explained and the booklet tells how to use the product. Stonhard Co.

146 Concrete Overlay — Rugged wear, this company's overlay compound for providing, durable, non-sparking, fireproof overlays for worn and damaged concrete, brick, stone, composition, steel or wood floors is described in this bulletin. The bulletin shows how the material is applied and lists its advantages. Flexrock Co.

147 Preventing Erosion in Condensers—This 16 pp., booklet is a report for engineers interested in economies in power production and prevention of erosion from water in motion. Debevoise Co.

148 Building Maintenance — Bulletin No. 10, 4 pp., describes the industrial protective coatings and paints for resisting the corrosive fumes of industrial atmospheres. Little hints and questions and answers to some problems are given. Truscon Laboratories.

149 Low Height Floor Machine—Bulletin KM-16, 4 pp., presents the specifications of this machine and lists the prices of machine and attachments General Floorcraft, Inc.

HOSE, VALVES, FITTINGS

150 Flexible Hose — Bulletin SS-100, 4 pp., describes this flexible hose made of stainless steel. The various types in which it is offered are given. Connecting flanges and male and female fittings are shown. Dimensions and data are given. Finn & Co.

151 Check Valves Data Booklet—Giving complete information and engineering data this new Bulletin 610A covers the company's line of check valves. The bulletin is greatly enhanced in value with some very excellent line drawings in color which aid in the explanation of its operation and construction. Photographs show "exploded" views of the valves and other photos picture applications. Service Recommendations are given. Grove Regulator Co.

152 Self-Flaring Tube Fitting—This 4 pp. bulletin explains and illustrates the self-flaring action of this fitting with cutaway views. Drawings show kinds of fitting available. Scovill Mfg. Co.

153 Expansible Tube Valves —Bulletin 800-B, 16 pp., explains the construction and operation of these valves with numerous drawings, both cross-sectional and flow. Also depicted are the various types of control and their piping arrangement to which valve can be applied. Photos show applications. Grove Regulator Co.

154 Application of Flexible Tubing — This 6 page folder contains many application and construction photos to show the wide use to which flexible tubing may be adapted. Pennsylvania Flexible Metallic Tubing Co.

155 Hydromatic Single Control Valve—Bulletin 4460, 8 pp., describes and depicts the application of these valves to water treatment systems. Piping diagrams showing valve applied to three different types of systems are given. Cochrane Corp.

156 Welding Pipe Fittings — An excellently done 24-page book on welding fittings for branch pipe outlets has just been issued. The manufacturer points out that the book shows the way to reduction in piping costs from 50 to 75 per cent. Three types of fittings are described: for butt welding, threaded, and socket welding. In addition, complete installation instructions, sizes, dimensions, weights, list prices, temperature-pressure ratings and material specifications are given. Bonney Forge & Tool Works.

157 Pump and Valve Applications—This 16 pp., bulletin illustrates and describes applications in which the three divisions of this company have placed their equipment. These include, pumps, planers, and regulating valves. Hamilton-Thomas Corp.

MATERIALS HANDLING

158 Selecting Lift Trucks — "How to Select the Proper Lift Truck," is one of the valuable sections in Bulletin K-48. Skid loading, width clearance and overhang are discussed in detail and plant factors to be considered in establishing the size skid and truck are explained also. In addition this new bulletin gives complete details and specifications on the company's line of lift trucks. Lift Trucks, Inc.

159 Pocket Hand Book—This company's well-known Junior Catalog 487 has been published in its 10th edition. Containing 100 pages, the book presents comprehensive information on materials handling equipment including hand, hydraulic and electric lift trucks, pallet trucks, lifter system, skids, stacking frames, lifting and die tables, portable work benches, hoists, elevators, portable cranes, and others. Barret-Cravens Co.

160 Elevating Conveyor—New bulletin gives helpful engineering information on Steel Belt elevating conveyor for lifting packages or lowering them, in warehouses or other sites and for loading or unloading to any height. Steel-Parts Mfg. Co.

161 Booklet on Pulleys — An exceptionally well-executed, 16-page Bulletin P-848, gives engineering data, ordering information, specifications, price lists and other material. The booklet is well arranged and well illustrated. Sprout Waldron & Co.

162 Two Post Hoists—Form No. 796, catalog sheet, describes and illustrates the use of these hoists for cars and trucks in fleet repair shops. Wayne Pump Co.

163 Punch Press Emptying Conveyor — Form PV-48, 4 pp., presents with illustrations, applications, sizes, special

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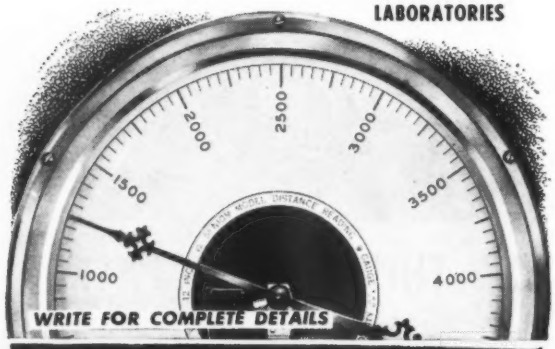

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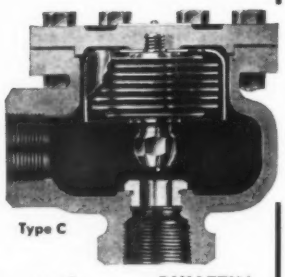
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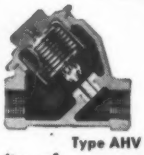
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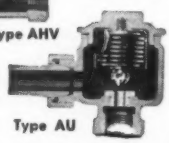
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features, general data on construction, and a specifications table, this short powered conveyor for carrying finished stamping away from the press. Rapids-Standard Co., Inc.

HEATING

164 Direct Fired Unit Heaters —This 4 pp., bulletin describes and depicts the application of these floor mounted unit heaters which employ the counter flow principle. Lee Engineering Co.

165 Cabinet Type Unit Heaters — Bulletin No. WN-133, 12 pp., is this firm's handbook on these unit heaters. Tables of steam capacities, Btu conversion factors, capacities with external resistance, air deliveries in cfm, hot water capacities, are given as well as control diagrams. Dimensional drawings and tables for various mountings given. Warren Webster & Co., and John J. Nesbitt, Inc.

166 Steam Boiler — Bulletin 505 describes a packaged steam boiler unit. Photographs show the equipment which is an integral part of the boiler and drawings and a table list the dimensions and specifications of the unit. Johnston Brothers, Inc.

167 Heat Insulation for Industry—This 16 pp., bulletin provides in tabular form: selection guides, condensed specifications, heat losses through furnace walls, conductivity graph, performance data, and selection of cements. Also discussed are other products for insulating. Philip Carey Mfg. Co.

168 Zig Zag Heat Exchanger — Bulletin ZC, catalog sheet, explains briefly the heat exchanger of zig zag construction. Unit is intended to recover heat from waste process steam and water. David Stout & Sons.

TOOLS

169 Metal Working Machines and Lathes—Catalog G-48, 16 pp., describes and depicts the metal working machinery offered. Also treated are the accessories. Specifications for each are given. Sheldon Machine Co., Inc.

170 Handbook on Drills and Reamers—Catalog No. 50, 225 pp., contains 45 pages of helpful technical data on the use of drills, tapers, drilling speeds, cutting oils, carbide tools, tap and pipe thread sizes. This section is really a hints and kinks help. Balance of handbook is made up of complete listing of all tools offered with prices. Request on company letterhead. Chicago Latrobe Twist Drill Wks.

171 Electric Hammer and Drill—Catalog sheet No. 485, describes the combination electric hammer and drill for drilling holes in concrete. Drill has detachable piece which converts it into a hammer. Specifications and prices are given. Wodack Electric Tool Corp.

172 Drum Polisher and Sander — This catalog sheet depicts the polisher and sander with accessories that features portability. Specifications are given. Portable Electric Tools, Inc.

173 Power Pipe Bender—Bulletin No. 34, 8 pp., gives operating instructions on this automatic pushbutton ram bender of 2 in. capacity. Photos illustrate operation. Also shown are the different shape bars that can be shaped. Use in making coils, radiant heat installations is given. Wallace Supplies Mfg. Co.

174 Electric Nut Setter—Bulletin SSI, 4 pp., describes and depicts the many applications for this nut setter. Cross-sections show the construction and assembly. Speed-O-Matic Sales, Inc.

175 Sparkproof Scraping Tools—Bulletin 93, 6 pp., illustrates seven tools and a spray booth kit. Tools are made of bronze and are claimed to reduce danger of fire and explosion. Ampco Metal, Inc.

MECHANICAL POWER TRANSMISSION

176 Magnetic Pulleys — Two new catalogs — Bulletins C-1001A and C-1007A—present a complete description of features and applications of electromagnetic pulleys and Alnico magnetic pulleys. Both catalogs were prepared as guides for magnetic separator users to help determine the type and size of pulley most suitable for specific requirements. Dings Magnetic Separator Co.

177 Over-Running Clutches —Catalog C, 16 pp., explains the full complement, over-running, and backstop features of this clutch. Construction details and engineering data on the forms available are given. Adaptations shown with cross-sectional drawings. Morse Chain Co.

178 Self-Aligning Roller Bearing Units — This 4 pp., bulletin contains information on this bearing which may be adjusted. These come in several styles. Shafer Bearing Corp.

MISCELLANEOUS

179 Combination Blast Gun —This 6 pp., folder describes the applications for which this combination blast and spray gun is suitable. Some uses are sand blasting, liquid sprayer, cleaning carbon, rust and oxidation. Engineered Products Inc.

180 Packings — Wood-Metal Packings is the subject of this booklet. Illustrations show how the packing performs over a period of years and the booklet tells about the various types of equipment and the types of chemicals and other media in which the packing may be employed. Installation instructions are given. Rains Wood-Metal Packings.

181 Retaining Rings Data Book—A data book which covers retaining rings used for the purpose of locating and positioning machine parts on shafts and in housings, has just been issued. The book contains 28 pages and is a compilation of engineering information and specification. The book is well arranged and tables are large and clear for ready reference. Truarc Div., Waldes Kohinoor.

182 Metallizing Spray Wire—Bulletin 57, catalog sheet, presents briefly the wire for metallizing guns. Recommendations for each type of gun are

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given. Metallizing Engineering Co.

183 **Progress in Power**—Bulletin No. 3724, 20 pp., depicts the growth and use of power in this nation and illustrates the use of this firm's equipment in that growth. American Blower Corp.

184 **Lubricants and Cutting Fluids Product Index**—This 6 pp., fold-out bulletin lists the oils, greases, solvents, cutting oils, cleaners, compounds for drawing, rust preventatives, core binders, inhibitors, carburizers, hydraulic oils, cotton, wool, rayon, and silk processing fluids, belt transmission products, packings, and leather oil and greases. E. F. Houghton & Co.

185 **Double Runner Attrition Mill**—Data Bulletin DRC-1, 4 pp., describes and illustrates applications, fineness of grind, and construction data of the mill. Dimensions, power data, weights, volumes, performance data, are given in tables. Parts list with drawings provided. Sprout-Waldron & Co.

186 **Condenser Tube End Inserts**—This 8 pp., bulletin contains the report on these inserts by a testing organization as well as flow diagrams, fluid friction charts, and installation sketches. Condenser Service and Engineering Co., Inc.

187 **Tool Steel Grade Chart**—This fold-out sheet presents in one large table a chart of comparable tool steel grades. Tool steels of many firms are presented in the list. McInnes Steel Co.

188 **Bulletin Catalog on Chemical Proportioning**—This 4 pp., bulletin presents short descriptions of the many bulletins available on chemical proportioning equipment. Proportioneers, Inc.

189 **Vibration Control Data**—Bulletin G-101, 4 pp., discusses the advantages and limitations of spring mountings, rubber mountings, and cork materials in the control of vibration. Data on installation and uses is given. Provided is an excellent isolation mount selector chart. Korfund Co.

190 **Castings in Industry**—"Nickel Alloy Steel Castings in Industry," is the title of this recently-issued 32-page book. The bulletin describes the uses to which this alloy has been put in various industries ranging from railroad equipment to mining and smelting and power plants. It is profusely illustrated. International Nickel Co., Inc.

191 **Crawler Tractor**—Bulletin A-93-LL, describes, depicts, and presents specifications for, this medium size crawler tractor. Outstanding points of construction and operation are discussed. International Harvester Co.

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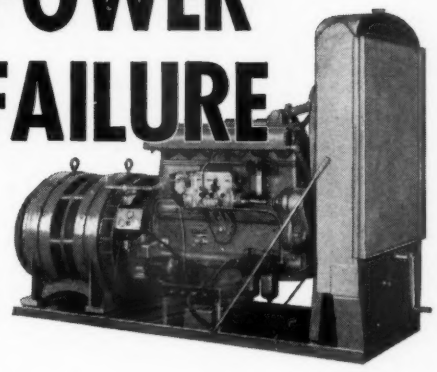

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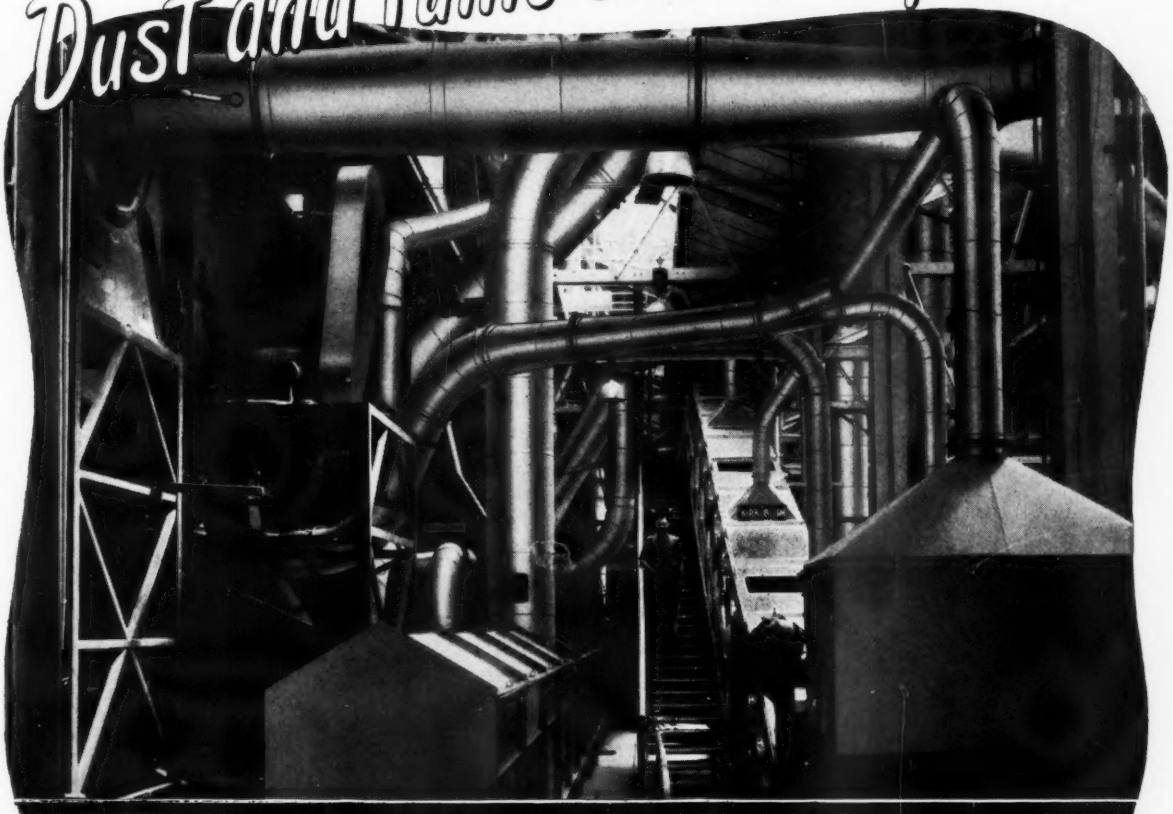

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Diagram by Huxley Madeheim
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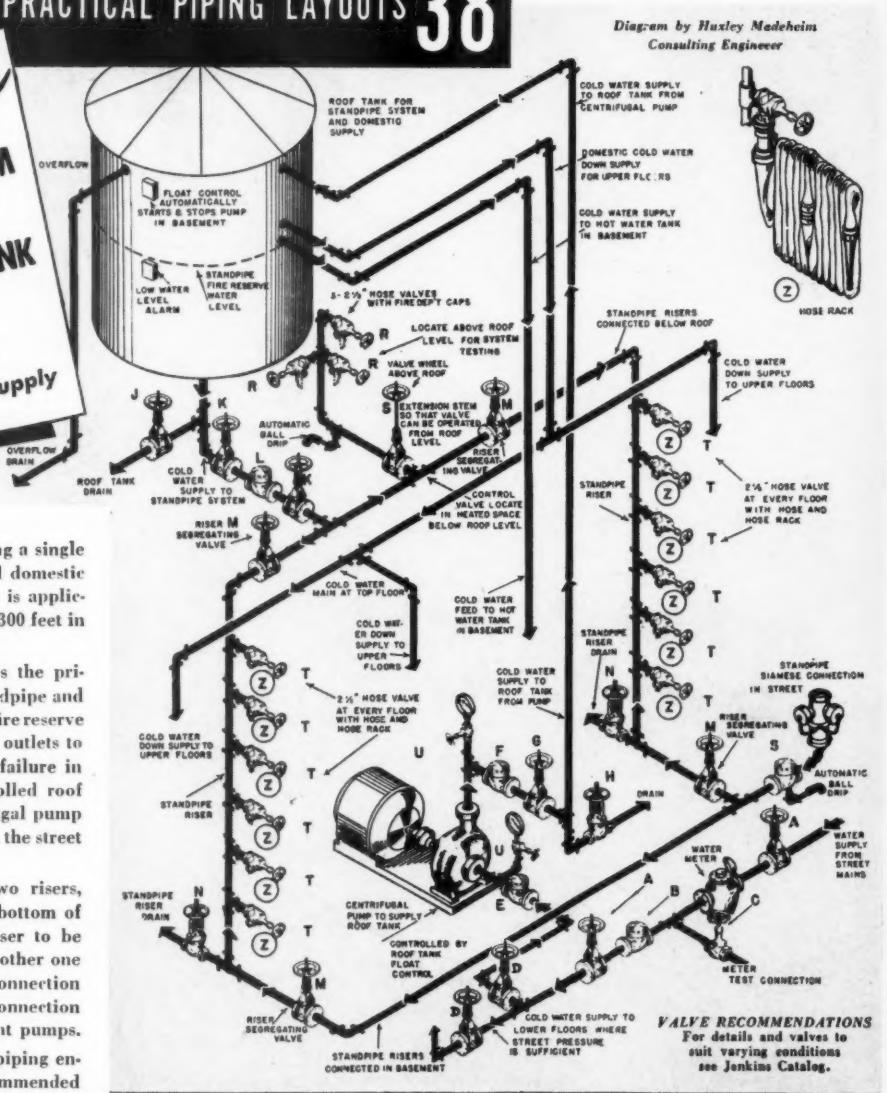
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B	1	*Fig. 629 I.B.B.M. Swing Check	Prevent Backflow to Mains
C	1	Fig. 106-A Bronze Globe	Water Meter Test Valve
D	2	*Fig. 825 I.B.B.M. Gate	Cold Water Supply Shutoff
E	1	*Fig. 629 I.B.B.M. Swing Check	Prevent Backflow from Pump
F	1	*Fig. 629 I.B.B.M. Swing Check	Prevent Backflow to Pump

Code	Quan.	Jenkins Valves	Service
G	1	*Fig. 825 I.B.B.M. Gate	Centrifugal Pump Discharge
H	1	Fig. 275-U Bronze Gate	Pump & Riser Drain
J	1	Fig. 651 I.B.B.M. Gate	Roof Tank Drain
K	2	Fig. 825 I.B.B.M. Gate	Roof Tank Shutoff
L	1	Fig. 629 I.B.B.M. Swing Check	Prevent Backflow to Roof Tank
M	4	Fig. 825 I.B.B.M. Gate	Standpipe Riser Segregation
N	2	Fig. 275-U Bronze Gate	Riser Drains
P	1	Fig. 825 I.B.B.M. Gate	Control Valve for Roof Test Hose Valves
R	3	Fig. 715-A Bronze Angle Hose	Roof Test Manifold
S	1	Fig. 629 I.B.B.M. Swing Check	Prevent Standpipe Water Draining thru Siamese
T	12	Fig. 715-A Bronze Angle Hose	Hose Shutoffs
U	2	Fig. 741-G Bronze Needle	Pressure Gage Control

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